



**【特許請求の範囲】****【請求項 1】**

絶縁基板上に形成される電極部を有し、半導体装置の端子部に対して該電極部の接続面を介して電氣的接続を行う電極板における該電極部の接続面に、該電極板の絶縁基板の線膨張率と異なる線膨張率の材料で作られ、凹凸が形成される表面を有する転写板の該表面と該接続面とを互いに接触するように載置する第 1 の工程と、  
前記第 1 の工程において前記電極部の接続面に載置された転写板を所定の圧力で該電極部の接続面に向けて押圧しつつ、該転写板および前記電極板を所定温度で所定期間、加熱する第 2 の工程と、  
前記転写板を前記電極板に対して離隔させ、前記電極部の接続面に所定の凹凸を得る第 3 の工程と、  
を含んでなる電極の回復処理方法。

**【請求項 2】**

前記第 2 の工程における所定温度および所定期間は、それぞれ、80℃以上から150℃未満までの温度範囲で、5分以上15分以下の期間に設定されることを特徴とする請求項 1 記載の電極の回復処理方法。

**【請求項 3】**

母材の耐磨耗性に比して優れた耐磨耗性を有する微小な結晶物を該母材中に所定量含んでなる電極部が絶縁基板上に形成され、半導体装置の端子部に対して該電極部の接続面を介して電氣的接続を行う電極板における該電極部の接続面に、該半導体装置の端子部を載置する第 1 の工程と、  
前記半導体装置の端子部を前記電極板の接続面に対して接触させつつ該接続面を摩耗させ、前記結晶物の一部を露出させることにより、所定の凹凸を該接続面に得る第 2 の工程と、  
を含んでなる電極の回復処理方法。

**【請求項 4】**

前記結晶物は、前記母材である銅の硬度よりも大なる硬度を有し、かつ、電気伝導度が比較的高いパラジウムまたはニッケルで作られることを特徴とする請求項 3 記載の電極の回復処理方法。

**【請求項 5】**

絶縁基板上に形成される電極部を有し、半導体装置の端子部に対して該電極部の接続面を介して電氣的接続を行う電極板における該電極部の接続面に、凹凸が形成される表面を有する転写板の該表面と該接続面とを互いに接触するように載置する第 1 の工程と、  
前記第 1 の工程において前記電極部の接続面に載置された転写板を所定の圧力で該電極部の接続面に向けて押圧しつつ、該転写板または該電極部の接続面を該接続面に対し略平行ないずれかの方向に所定量、少なくとも 1 回、相対的に移動させる第 2 の工程と、  
前記転写板を前記電極板に対して離隔させ、前記電極部の接続面に所定の凹凸を得る第 3 の工程と、  
を含んでなる電極の回復処理方法。

**【請求項 6】**

前記第 2 の工程において、前記電極板を支持しつつ前記電極部の接続面に対し略平行に移動させる摺動装置により前記転写板に対し該電極板が移動せしめられることを特徴とする請求項 5 記載の電極の回復処理方法。

**【請求項 7】**

前記第 2 の工程における押圧力が、一つの電極部あたり 1 g 以上 100 g 以下であることを特徴とする請求項 1 または請求項 5 記載の電極の回復処理方法。

**【請求項 8】**

前記第 2 の工程における相対的な移動の所定量が、1 μm 以上 1 mm 以下であることを特徴とする請求項 5 記載の電極の回復処理方法。

**【発明の詳細な説明】**

## 【0001】

## 【発明の属する技術分野】

本発明は、半導体装置の端子に対し電氣的接続を行う電極部を有する電極板の電極部の接続面を所定の表面粗さとなるように回復させることができる電極の回復処理方法に関する。

## 【0002】

## 【従来の技術】

電子機器用ICソケットまたはコネクタにおいては、一般に、配線用基板の電極に装着される半導体装置の端子が電氣的に確実に接続されることが要望される。このような装置においては、例えば、特開平8-96865号公報、および、特開2000-294043号公報にも示されるように、半導体装置の端子（電極）が電氣的に接続される導体パターンの電氣接点部、あるいは、導電路の端面に、その端子に形成される酸化被膜を突き破るために十分なセラミック溶射被膜を溶射により、または微小突起をエッチング処理により形成することが提案されている。このように微小突起が電氣接点部、あるいは、導電路の端面に形成されることにより、互いの接触面積が低減され、かつ、単位面積あたりの接触圧力が増大するので酸化被膜が破壊され易いという効果を奏することとなる。

## 【0003】

その結果、半導体装置の端子が配線用基板の電極に電氣的に確実に接続されることとなる。

## 【0004】

## 【発明が解決しようとする課題】

上述のような電子機器用ICソケットにおいては、導体パターンの電氣接点部が繰り返し使用される場合、上述のような耐磨耗性を有する微小突起およびセラミック溶射被膜の耐久性にも一定の寿命があるので微小突起が接触圧力等により摩耗することとなる。従って、その電氣接点部、あるいは、導電路の端面は、使用頻度に応じ回復することなく、凹凸のない略平坦な表面となるので接触面積が増大し、かつ、接触圧力が不十分となる虞がある。その結果、当初得られた確実な電氣的な接続が、使用するにつれて得られなくなる場合がある。

## 【0005】

以上の問題点を考慮し、本発明は、半導体装置の端子に対し電氣的接続を行う電極部を有する電極板の電極部の接続面を所定の表面粗さとなるように回復させることができる電極の回復処理方法であって、摩耗した電極板の電極部の接続面に容易にかつ確実に所定の凹凸を形成することができる電極の回復処理方法を提供することを目的とする。

## 【0006】

## 【課題を解決するための手段】

上述の目的を達成するために、本発明に係る電極の回復処理方法は、絶縁基板上に形成される電極部を有し、半導体装置の端子部に対して電極部の接続面を介して電氣的接続を行う電極板における電極部の接続面に、電極板の絶縁基板の線膨張率と異なる線膨張率の材料で作られ、凹凸が形成される表面を有する転写板の表面と接続面とを互いに接触するように載置する第1の工程と、第1の工程において前記電極部の接続面に載置された転写板を所定の圧力で電極部の接続面に向けて押圧しつつ、転写板および該電極板を所定温度で所定期間、加熱する第2の工程と、転写板を前記電極板に対して離隔させ、電極部の接続面に所定の凹凸を得る第3の工程と、を含んでなる。

## 【0007】

また、第2の工程における所定温度および所定期間は、それぞれ、80℃以上から150℃未満までの温度範囲で、5分以上15分以下の期間に設定されてもよい。

## 【0008】

さらに、本発明に係る電極の回復処理方法は、母材の耐磨耗性に比して優れた耐磨耗性を有する微小な結晶物を母材中に所定量含んでなる電極部が絶縁基板上に形成され、半導体装置の端子部に対して電極部の接続面を介して電氣的接続を行う電極板における電極部の



接続面に、半導体装置の端子部を載置する第1の工程と、半導体装置の端子部を電極板の接続面に対して接触させつつ接続面を摩耗させ、結晶物の一部を露出させることにより、所定の凹凸を接続面に得る第2の工程とを含んでなる。

【0009】

結晶物は、母材である銅の硬度よりも大なる硬度を有し、かつ、電気伝導度が比較的高いパラジウムまたはニッケルで作られてもよい。

【0010】

さらにまた、本発明に係る電極の回復処理方法は、絶縁基板上に形成される電極部を有し、半導体装置の端子部に対して電極部の接続面を介して電氣的接続を行う電極板における該電極部の接続面に、凹凸が形成される表面を有する転写板の表面と接続面とを互いに接10  
触するように載置する第1の工程と、第1の工程において電極部の接続面に載置された転写板を所定の圧力で電極部の接続面に向けて押圧しつつ、転写板または電極部の接続面を接続面に対し略平行ないずれかの方向に所定量、少なくとも1回、相対的に移動させる第2の工程と、転写板を電極板に対して離隔させ、電極部の接続面に所定の凹凸を得る第3の工程と、を含んでなる。

【0011】

また、第2の工程において、電極板を支持しつつ電極部の接続面に対し略平行に移動させる摺動装置により転写板に対し電極板が移動せしめられるものでもよい。

【0012】

第2の工程における押圧力が、一つの電極部あたり1g以上100g以下であってもよく20  
、また、第2の工程における相対的な移動の所定量が、1 $\mu$ m以上1mm以下であってもよい。

【0013】

【発明の実施の形態】

図7は、本発明に係る電極の回復処理方法の第1の実施例、後述する第2の実施例および第3の実施例が適用される接続用電極板を備える半導体装置用ソケットを示す。

【0014】

図7に示される半導体装置用ソケットにおいては、例えば、半導体装置の電氣的特性試験、具体的にはバーンイン試験等利用されるものとされる。半導体装置用ソケットは、半導体装置としてのベアチップが内部に收容されるキャリアユニット40と、キャリアユニ30  
ット40が着脱可能に收容部に装着されるICソケット30とを含んで構成されている。

【0015】

ICソケット30は、ベアチップへの検査信号およびベアチップからの検出出力信号等の入出力を行なうプリント配線基板38上に配置され、キャリアユニット40を收容する收容部を有する本体部32と、本体部32に設けられ、キャリアユニット40における構成要素となる後述する接続用電極板としてのコンタクトシートの各パッドにそれぞれ電氣的に接続される複数のコンタクトからなるコンタクト群34と、本体部32に対し昇降動可能に配されコンタクト群34の各接点部を選択的にコンタクトシートの各パッドに選択的に電氣的に接続するカバー部材36とを主要要素として構成されている。

【0016】

樹脂材料で成形される本体部32は、プリント配線基板38の電極部に対応して所定位置に配置されている。本体部32は、図7に示されるように、キャリアユニット40が收容される收容部32Aを有している。收容部32Aは、後述するキャリアユニット40のベース部の下部に係合される下部基台部32aの内周部と、下部基台部32aに連なりそのベース部の上部に係合される上部基台部32bの内周部とにより包囲されて形成されている。下部基台部32aには、コンタクト群34が支持されている。下部基台部32aおよび上部基台部32bには、コンタクト群34を構成する各コンタクト34a<sub>i</sub> (i=1~n, nは整数)が挿入されるスリットが形成されている。

【0017】

各コンタクト34a<sub>i</sub> (i=1~n, nは整数)は、下部基台部32aに圧入されている50

端子部34Tと、端子部34Tに連なりコンタクトシートのパッドに下方側から電氣的に接続される固定側接点部34fと、弾性を有し端子部34Tに連なりコンタクトシートのパッドに上方側から電氣的に接続される可動側接点部34mと、可動側接点部34mから分岐され後述するカバー部材36の斜面部に選択的に係合されて可動側接点部34mを固定側接点部34fに対して離隔する方向に回動させる被係合部34eとを含んで構成されている。

【0018】

各コンタクト34aiは、図7において、後述するコンタクトシート44のパッドに対応して紙面に対し略垂直方向に沿って所定の間隔で配列されている。なお、図7においては、収容部32Aの四方を取り囲むコンタクト群34のうちの一边に対応する部分のみのコンタクト群34を示す。 10

【0019】

樹脂材料で成形されるカバー部材36は、キャリアユニット40が通過する開口部36aを有している。開口部36aの周縁を形成する枠状部分は、本体部32の外周部に設けられる溝に案内される脚部により、昇降動可能に支持されている。なお、カバー部材36は、図示が省略される弾性部材により、本体部32に対し離隔する方向に付勢されている。その枠状部分の各辺の下端には、図7の二点鎖線で示されるように、カバー部材36が所定位置まで下降せしめられるとき、上述の各コンタクト34aiの被係合部34eに係合し可動側接点部34mをその弾性力に抗して固定側接点部34fに対して離隔する方向に回動させる斜面部36sがそれぞれ形成されている。 20

【0020】

後述するキャリアユニット40がICソケット30の本体部32の収容部32Aに装着される場合、カバー部材36が所定量、押し下げ保持されることにより、コンタクト群34の各可動接点部34mが収容部32Aに対し後退せしめられた後、上方から開口部36aを介してキャリアユニット40が収容部32A内に位置決めされ載置される。その際、固定側接点部34fは、キャリアユニット40におけるコンタクトシート44のパッドの下面側に当接せしめられる。

【0021】

続いて、保持された状態のカバー部材36が解放されるとき、上述の弾性体の復帰力、および各コンタクト34aiの被係合部34eの弾性力の合力によりカバー部材36が上昇せしめられる。その際、コンタクト群34の各可動接点部34mは、元の位置に戻され、キャリアユニット40のコンタクトシート44のパッドの上面側に当接せしめられる。それにより、図7に示されるように、コンタクトシート44とコンタクト群34とが電氣的に接続されることになる。 30

【0022】

キャリアユニット40は、図8に示されるように、ベアチップ60が収容される収容部46Aを有するキャリアハウジング46と、キャリアハウジング46の収容部46Aの底部を形成するベース部材42上に弾性シート58を介して配されるコンタクトシート44と、ベアチップ60の電極群をコンタクトシート44のバンプ44Bに対して押圧する押圧体56を含んでなる押圧用蓋52と、押圧用蓋52をキャリアハウジング46に選択的に保持するラッチ機構50（図7参照）とを含んで構成されている。 40

【0023】

押圧用蓋52は、図8に示されるように、ベアチップ60の上面に当接する押圧面56aを有する押圧体56と、押圧体56の基部を収容する蓋本体64と、押圧体56の基部の凹部と蓋本体64の比較的深い凹部との間の空間に配され押圧体56をベアチップ60に向けて付勢する複数のスプリング54とを含んで構成されている。

【0024】

略正方形のベアチップ60は、例えば、所定の電極群をコンタクトシート44のバンプに対向する下面に有している。

【0025】

押圧体56の基部は、蓋本体64の比較的浅く広い凹部内に移動可能に挿入されている。その押圧体56が挿入される部分の端部には、蓋本体64の下端に設けられる爪部に係合される爪部56nが相対向して複数個形成されている。これにより、押圧体56がスプリング54の付勢力で付勢された状態で蓋本体64に保持されることとなる。

#### 【0026】

蓋本体64は、その対向する両端部にそれぞれ、ラッチ機構50のフック部材48Aおよび48Bが係合される突起部64pを有している。突起部64pは、後述するように、押圧用蓋52の装着のとき、フック部材48Aおよび48Bの先端の傾斜面に係合し、フック部材48Aおよび48Bを互いに離隔する方向に押圧する斜面部64psを有している。

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#### 【0027】

ラッチ機構50は、キャリアハウジング46の両端にそれぞれ、回転可能に支持され蓋本体64を保持するフック部材48Aおよび48Bと、フック部材48Aおよび48Bをそれぞれ、図7において矢印の示す方向、即ち、蓋本体64の突起部64pに係合させる方向に付勢するねじりコイルばね66と、フック部材48A、48B、およびねじりコイルばね66を支持する支持軸68とを含んで構成されている。

#### 【0028】

キャリアハウジング46の両端部には、押圧用蓋52が装着されるとき、蓋本体64の下部の外周部を案内するガイド部46gが形成されている。ガイド部46gの周囲には、支持軸68の両端部が支持されている。

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#### 【0029】

コンタクトシート44は、図8および図9に示されるように、電氣的に接続されるベアチップ60の電極群に対応した配列で複数のバンプ44Bを基材44M内に有している。例えば、母材となる銅の表面がニッケルおよび金メッキ処理されて形成される各バンプ44Bの先端は、その基材44Mの表面から所定の高さだけ突出している。基材44Mは、例えば、ポリイミド樹脂材料（線膨張係数： $35 \times 10^{-6} / ^\circ\text{C}$ ）で薄板状に作られ、約40 $\mu\text{m}$ 程度の厚さを有している。

#### 【0030】

各バンプ44Bは、図9に示されるように、銅箔で作られる導体層44cを介してパッド44pに接続されている。パッド44pは、基材44Mにおいてベース部材42の両端部からそれぞれ、外部に向けて突出する両端部に形成されている。

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#### 【0031】

なお、コンタクトシート44における複数のバンプ44Bの形成される部分は、ベース部材42の表面に略平行に相対的に所定の範囲だけ移動可能に支持されている。

#### 【0032】

かかる構成において、キャリアユニット40内にベアチップ60を装着するにあたっては、まず、ベアチップ60の電極群がコンタクトシート44のバンプ44Bに対して位置決めされ、ベアチップ60の電極群がバンプ44Bに当接するように配置される。次に、押圧用蓋52がキャリアハウジング46の収容部46A内に挿入される。その際、押圧用蓋52の蓋本体64の斜面部64psにより、ねじりコイルばね66の付勢力に抗してラッチ機構50のフック部材48Aおよび48Bの先端が互いに離隔する方向に回転される。また、蓋本体64の外周面がガイド部46gの内面に案内されつつ、押圧体56の押圧面56aがスプリング54の付勢力に抗してベアチップ60の上面に押し付けられる。

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#### 【0033】

続いて、ねじりコイルばね66より付勢されることにより、フック部材48Aおよび48Bの先端が互いに近接する方向に回転され蓋本体64の突起部64pに係合される。その結果、押圧用蓋52がキャリアハウジング46に保持されることとなる。

#### 【0034】

そして、そのキャリアユニット40が上述したように収容部32Aに装着された状態でベアチップ60に対し所定の雰囲気中で試験が実行されることとなる。

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## 【0035】

そのような試験にあたり、上述のようなコンタクトシート44は、所定数の装着される新たなベアチップ60に対し繰り返し利用されることとなる。

## 【0036】

このような試験に供される以前、各バンプ44Bは、当初、図5(A)に拡大されて示されるように、略円錐状の形状を有している。また、バンプ44Bの最先端部には、図6(A)に拡大されて示されるように、微小な凹凸44aがその表面全体に形成されている。

## 【0037】

次に、コンタクトシート44が試験に供されるとき、図5(B)および図6(B)に拡大されて示されるように、バンプ44Bの最先端部は、所定の潰し代をもって所定の圧力でベアチップ60の電極面に、当接されることとなる。 10

## 【0038】

続いて、一枚のコンタクトシート44が所定数のベアチップ60に対し繰り返し利用されることにより、図5(C)および図6(C)に拡大されて示されるように、各バンプ44B'の最先端部は、押し潰され、平坦面を有する略円錐台形状となる。そのような各バンプ44B'の平滑な平坦面44fsは、図6(A)に示されるような微小な凹凸を有していないものとなる。

## 【0039】

従って、一枚のコンタクトシート44が交換されることなく所定回数以上使用される場合、コンタクトシート44およびベアチップ60相互間の電氣的接続が不確実となる虞がある。 20

## 【0040】

そこで、本発明に係る電極の回復処理方法の第1実施例においては、予め、図1(A)に示されるような、所定の厚さを有する転写板10が用意される。その転写板10は、例えば、表面処理としてクロム（線膨張係数：約 $6.2 \times 10^{-6} / ^\circ\text{C}$ ）でメッキ処理した冷間工具鋼（JIS記号SKS, SKD）（線膨張係数：約 $11.5 \times 10^{-6} / ^\circ\text{C}$ ）で作られ、少なくとも一方側の転写面10sに、図2(A)に拡大されて示されるように、所定の粗さの凹凸10aを有している。

## 【0041】

先ず、図1(A)に示されるように、バンプが摩耗したコンタクトシート44が、配置されるとともに、ベアチップ60の代わりに転写板10が装着された上述のキャリアユニット40が所定の室内温度を維持する恒温槽12内に配置される。恒温槽12は、室内の温度を可変に調整できる温度調整器を備えるものとされる。 30

## 【0042】

その際、転写板10は、その転写面10sが恒温槽12内の各バンプ44B'の摩耗した平坦面44fsに接触するように複数の平坦面44fsにより形成される共通平面上に配置される。従って、転写板10は、複数のバンプ44B'の平坦面44fsにより支持されることとなる。その際、押圧体56を介してスプリング54の付勢力により、図1(A)に示される矢印Fの示す方向に沿って所定の圧力で加圧される。その加圧力は、例えば、1個のバンプ44Bあたり約1g以上100g以下の範囲に設定されている。本願の発明者による検証によれば、加圧力が1個のバンプ44Bあたり約1g未満の場合、回復処理の効果が殆どなく、また、加圧力が1個のバンプ44Bあたり100gを越える場合、バンプ44Bの突出高さが基準よりも低くなりすぎ、かつ、バンプ44Bの先端の潰れが比較的大となることにより、被検査物の電極に比較的大きな損傷を及ぼすという問題が生じることが確認されたのでその加圧力は、例えば、1個のバンプ44Bあたり約1g以上100g以下の範囲に設定されている。 40

## 【0043】

図3(B)は、転写面10sが平坦面44fsに接触し加圧された直後のバンプ44B'の先端部の状態を拡大して示す。これにより、図3(B)から明らかなように、バンプ44B'の先端部は、転写板10の凹凸10aにより押圧され比較的大きな凹凸44psが形 50

成されることとなる。

【0044】

次に、恒温槽12内の温度が例えば、標準状態から80℃以上から150℃までの範囲に上昇せしめられ、5分以上維持される。なお、恒温槽12内の温度および維持する期間は、好ましくは、室温150℃で15分程度に設定される。

【0045】

従って、転写板10およびコンタクトシート44は、それぞれ、室温の温度上昇につれて例えば、図1(A)の矢印Eの示す方向に膨張した場合においては、基材44Mの熱膨張係数は、上述したように転写板10の線膨張係数よりも大に設定されているのでコンタクトシート44は、図3(B)に示される凹凸44psと転写面10sとの相互間の摩擦力に抗して転写板10の伸びに比して相対的に大に延びることとなる。その結果、凹凸44psが形成される面は、コンタクトシート44およびバンプ44B'の転写面10sの微小な凹凸10aに対する数十μm程度の相対的な摺動によりさらに削られ、図3(C)に示されるような、その表面粗さがより細かな粗さの凹凸44msが形成されることとなる。

【0046】

続いて、回復処理されたバンプ44B''を有するコンタクトシート44''が図1(B)に示されるように、キャリアユニット40から取り出される。

【0047】

従って、図2(B)および図3(D)に拡大されて示されるように、バンプ44B''の最先端の面44esには、比較的大きな押圧力を加えることなく、転写板10における転写面10sの微小な凹凸10aの押圧および摺動に対応した比較的微細な凹凸44msが形成されることとなる。

【0048】

また、上述のように、加熱することにより、バンプ44Bが変形し易くなるので上述の凹凸の形成がより容易となる。

【0049】

図4(A)、(B)、(C)は、それぞれ、本願発明の発明者により検証された比較例におけるバンプ44B'の各工程の状態を示す。

【0050】

その比較例においては、電極の回復処理を行うにあたり、上述の例のように加熱されることなく、上述のキャリアユニット40内に、上述の例と同様に図4(A)に拡大されて示されるような、バンプ44B'が摩耗したコンタクトシート44が配され、かつ、上述のようにベアチップ60の代わりに同様な転写板10が装着されるだけのものとされる。

【0051】

斯かる比較例においては、押圧体56を介してスプリング54の付勢力により、図1(A)に示される矢印Fの示す方向に沿って上述の例と同様な所定の圧力でバンプ44B'が転写板10により加圧される。図4(B)は、転写面10sが平坦面44fsに接触し加圧された直後のバンプ44BCの先端部の状態を拡大して示す。これにより、図4(B)から明らかなように、バンプ44BCの先端部は、転写板10の凹凸10aにより押圧され比較的粗い凹凸44psが形成されることとなる。

【0052】

次に、回復処理されたバンプ44BCを有するコンタクトシートが、キャリアユニット40から取り出される。

【0053】

従って、図4(C)に拡大されて示されるように、バンプ44BCの最先端の面には、転写板10における転写面10sの微小な凹凸10aの押圧に対応した比較的粗い凹凸44psが形成されることとなる。

【0054】

その結果、比較例の方法においては、本願の実施例1において得られるような比較的微細



な凹凸44msが形成されないことが確認された。

【0055】

加えて、本願発明においては、上述したような転写面10sとバンプ44Bとの間の相対的な摺動により、バンプ44Bの接続面にヤスリをかけたような効果が得られ、しかも、押圧だけにより転写を行う場合に比してその凹凸の間隔がより狭くかつ凹凸が確実に形成されることとなる。

【0056】

図10(A)、(B)、(C)は、本発明に係る電極の回復処理方法の第2の実施例における各工程を模式的に示す。

【0057】

図10(A)～(C)に示される例に用いられるコンタクトシート80は、図10(A)に示されるように、電氣的に接続されるベアチップ60の電極群に対応した配列で複数のバンプ84Bを基材84M内に有している。その各バンプ84Bの先端は、その基材84Mの表面から所定の高さだけ突出している。その先端の表面全体には、図11(A)に拡大されて示されるように、微小な凹凸84aが形成されている。

【0058】

各バンプ84Bは、銅箔で作られる導体層84Cを通じてパッド（不図示）に電氣的に接続されている。そのパッドは、基材84Mにおいて上述のようなベース部材42の両端部からそれぞれ、外部に向けて突出する両端部に形成されている。各バンプ84Bは、例えば、母材となる金（ヌープ硬度：80～200）または銅（ヌープ硬度：250～320）に所定の結晶物86が略均一に混合された材料で略円錐状に形成されている。

【0059】

結晶物86は、母材が金の場合、金の硬度よりも大なる硬度を有し比較的電気伝導度の高い約2～3μmの粒子径のパラジウム（Pd）（ヌープ硬度：250～350）で作られ、約15～20%/vol程度の含有率で混合されている。

【0060】

また、結晶物86は、母材が銅の場合、銅の硬度よりも大なる硬度を有し比較的電気伝導度の高い約2～3μmの粒子径のニッケル（Ni）（ヌープ硬度：300～490）で作られ、約15～20%/vol程度の含有率で混合されている。

【0061】

基材84Mは、例えば、ポリイミド樹脂材料（線膨張係数： $35 \times 10^{-6} / ^\circ\text{C}$ ）で薄板状に作られ、約40μm程度の厚さを有している。

【0062】

斯かるコンタクトシート80の電極としてのバンプ84Bを回復処理するにあたっては、一枚のコンタクトシート80が上述のキャリアユニット40内に上述のように配置されるもとの、ベアチップ60に対し繰り返し利用されることによりバンプ84Bの先端の接続面が自動的に回復処理されることとなる。従って、上述の第1実施例において用いられている転写板10の押圧工程および加熱工程が不要とされる。

【0063】

即ち、キャリアユニット40内のコンタクトシート80が試験に供されるとき、図10(B)および図11(B)に拡大されて示されるように、バンプ84Bの最先端部は、所定の潰し代をもって所定の圧力でベアチップ60の電極面に、当接されることとなる。

【0064】

続いて、一枚のコンタクトシート80が所定数のベアチップ60に対し繰り返し利用されることにより、図10(C)および図11(C)に拡大されて示されるように、各バンプ84B'の最先端部は、押し潰され、略平坦な面を有する略円錐台形状となる。そのような各バンプ84B'の先端面84fsには、図11(C)に示されるように、母材の摩耗によって含有される複数の結晶物86の一部が露出することにより、微小な凹凸が形成されることとなる。

【0065】

従って、新たな微小な凹凸のある面が、各バンプ 8 4 B' の最先端部の母材の摩耗に伴ない、各バンプ 8 4 B' の最先端部に自動的に形成されることとなる。

【0066】

上述の本発明に係る電極の回復処理方法の第 1 の実施例に用いられるキャリアユニット 4 0 においては、コンタクトシート 4 4 における複数のバンプ 4 4 B の形成される部分は、ベース部材 4 2 の表面に略平行に相対的に所定の範囲だけ移動可能に支持されている。

【0067】

しかしながら、キャリアユニット 4 0 の構造は、必ずしもこのようになされる必要がなく、例えば、図 1 2 (A) および (B) ~ 図 1 4 (A) および (B) に示されるキャリアユニットが用いられても良い。

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【0068】

図 1 2 (A) において、キャリアユニットは、上述の例と同様に、ベアチップ 6 0 または転写板 1 0 が収容される収容部 4 7 A を有するキャリアハウジング 4 7 と、キャリアハウジング 4 7 の収容部 4 7 A の底部を形成するベース部材 4 3 と、ベース部材 4 3 上に弾性シート 4 1 を介して配されるコンタクトシート 4 5 と、ベアチップ 6 0 の電極群または転写板 1 0 をコンタクトシート 4 5 のバンプ 4 5 B に対して押圧する押圧体を含んでなる押圧用蓋 5 2 と、押圧用蓋 5 2 をキャリアハウジング 4 7 に選択的に保持するラッチ機構 4 9 とを含んで構成されている。なお、押圧用蓋 5 2 およびラッチ機構 4 9 の構造は、上述の第 1 の実施例における押圧用蓋およびラッチ機構の構造と同一なのでその重複説明を省略する。

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【0069】

キャリアハウジング 4 7 は、上述の転写板 1 0 の線膨張率よりも大なる線膨張率を有する材料、例えば、樹脂材料により成形されている。樹脂材料としては、例えば、ポリエーテルイミド（線膨張係数： $56 \times 10^{-6} / ^\circ\text{C}$ ）が望ましい。キャリアハウジング 4 7 の収容部 4 7 A の内周部は、図 1 2 (B) に示されるように、押圧用蓋 5 2 が装着されるとき、押圧用蓋 5 2 の外周部を案内し所定位置に位置決めするように形成されている。キャリアハウジング 4 7 の収容部 4 7 A の底面部には、中央の開口部 4 7 b の周囲に後述する締結部材 5 1 が挿入される孔 4 7 a が 4 箇所形成されている。

【0070】

コンタクトシート 4 5 は、電氣的に接続されるベアチップ 6 0 の電極群に対応した配列で複数のバンプ 4 5 B を基材 4 5 M 内に有している。例えば、母材となる銅の表面がニッケルおよび金メッキ処理されて形成される各バンプ 4 5 B の先端は、その基材 4 5 M の表面から所定の高さだけ突出している。基材 4 5 M は、例えば、ポリイミド樹脂材料（線膨張係数： $35 \times 10^{-6} / ^\circ\text{C}$ ）で薄板状に作られ、約  $40 \mu\text{m}$  程度の厚さを有している。

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【0071】

各バンプ 4 4 B は、銅箔で作られる導体層を介してパッド 4 5 p に接続されている。複数のパッド 4 5 p は、基材 4 5 M においてベース部材 4 3 の両端部からそれぞれ、外部に向けて突出する両端部に形成されている。

【0072】

コンタクトシート 4 5 は、キャリアハウジング 4 7 の孔 4 7 a に対応して締結部材 5 1 が挿入される孔 4 5 a を複数のバンプ 4 4 B の周辺に有している。

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【0073】

ベース部材 4 3 は、キャリアハウジング 4 7 の材料と同一材料により成形されており、キャリアハウジング 4 7 の孔 4 7 a およびコンタクトシート 4 5 の孔 4 5 a に対応して孔 4 3 a を有している。

【0074】

コンタクトシート 4 5 の複数のバンプ 4 4 B の真下に配される弾性シート 4 1 が果たす役割のひとつは、上述の例と同様に各バンプ 4 5 B の突出高さに起因するバンプ 4 5 B の接触力のばらつきを均一にすることである。

【0075】

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図12 (B) に示されるように、コンタクトシート45を挟んでキャリアハウジング47とベース部材43とを互いに締結する締結部材51としては、例えば、リベット、または、ビスおよびナットが好ましい。

【0076】

このようなキャリアユニットが用いられるとき、バンプの回復処理にあたっては、上述の第1の実施例と同様に、先ず、バンプが摩耗したコンタクトシート45が、配置されるとともに、ベアチップ60の代わりに転写板10が装着された上述のキャリアユニットが所定の室内温度を維持する恒温槽12内に配置される。

【0077】

押圧力の条件は、上述の第1の実施例と同様に設定される。

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【0078】

次に、恒温槽12内の温度が例えば、標準状態から80℃以上から150℃までの範囲に上昇せしめられ、5分以上維持される。なお、恒温槽12内の温度および維持する期間は、好ましくは、室温150℃で15分程度に設定される。

【0079】

従って、転写板10と、ベース部材43、キャリアハウジング47およびコンタクトシート45とは、それぞれ、室温の温度上昇につれて膨張した場合においては、キャリアハウジング47等の線膨張係数は、上述したように転写板10の線膨張係数よりも大に設定されているのでコンタクトシート45は、転写面10sとの相互間の摩擦力に抗して転写板10の伸びに比して相対的に大に延びることとなる。その結果、上述の第1の実施例と同様に、その表面粗さがより細かな粗さの凹凸が各バンプ45Bの先端に形成されることとなる。

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【0080】

図13 (A) および (B) は、それぞれ、本発明に係る電極の回復処理方法の一例に用いられる他のキャリアユニットを示す。

【0081】

図12 (A) および (B) に示されるキャリアユニットにおいては、締結部材51により、コンタクトシート45を挟んでキャリアハウジング47とベース部材43とが互いに締結されているが、その代わりに、図13 (A) および (B) においては、接着剤または融接により、コンタクトシート45を挟んでキャリアハウジング47とベース部材43とが互いに接合される。なお、図13 (A) および (B) においては、図12 (A) および (B) において同一とされる構成要素について同一の符号を付して示し、その重複説明を省略する。

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【0082】

キャリアハウジング47' は、上述の転写板10の線膨張率よりも大なる線膨張率を有する材料、例えば、樹脂材料により成形されている。樹脂材料としては、例えば、ポリエーテルイミド（線膨張係数： $56 \times 10^{-6} / ^\circ\text{C}$ ）が望ましい。キャリアハウジング47' の収容部47' Aの内周部は、図13 (B) に示されるように、押圧用蓋52が装着されるとき、押圧用蓋52の外周部を案内し所定位置に位置決めするように形成されている。キャリアハウジング47' の収容部47' Aの底面を形成する底面部には、中央に開口部47' bが形成されている。

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【0083】

ベース部材43' は、キャリアハウジング47' の材料と同一材料により成形されており、コンタクトシート45の孔45aにそれぞれ対応して位置決めピン43' Pを4箇所有している。位置決めピン43' Pは、弾性シート41が配される面に対して所定の長さ、例えば、コンタクトシート45の厚さ程度だけ突出している。位置決めピン43' Pは、コンタクトシート45のベース部材43' に対する相対位置を位置決めするとともに、ベース部材43' の熱膨張または収縮の変位に応じてコンタクトシート45を同様に変位させるためのものとされる。ベース部材43' のキャリアハウジング47' の収容部47' Aに対する相対位置は、融接のとき、位置決めされる。

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## 【0084】

斯かる例においても、転写板10と、ベース部材43'、キャリアハウジング47'およびコンタクトシート45とは、それぞれ、室温の温度上昇につれて膨張した場合においては、キャリアハウジング47'等の線膨張係数は、上述したように転写板10の線膨張係数よりも大に設定されているのでコンタクトシート45は、転写面10sとの相互間の摩擦力に抗して転写板10の伸びに比して相対的に大に延びることとなる。その結果、上述の第1の実施例と同様に、その表面粗さがより細かな粗さの凹凸が各バンプ45Bの先端に形成されることとなる。

## 【0085】

図14(A)および(B)は、それぞれ、本発明に係る電極の回復処理方法の一例に用いられるさらなる他のキャリアユニットを示す。 10

## 【0086】

図13(A)および(B)に示されるキャリアユニットにおいては、コンタクトシート45を挟んでキャリアハウジング47'と位置決めピン43'Pを有するベース部材43'とが互いに接合されているが、その代わりに、図14(A)および(B)においては、接着剤または融接により、コンタクトシート45を挟んで位置決めピン47" Pを有するキャリアハウジング47"とベース部材43"とが互いに接合されるものとされる。なお、図14(A)および(B)においては、図12(A)および(B)において同一とされる構成要素について同一の符号を付して示し、その重複説明を省略する。

## 【0087】

キャリアハウジング47"は、上述の転写板10の線膨張率よりも大なる線膨張率を有する材料、例えば、樹脂材料により成形されている。樹脂材料としては、例えば、ポリエーテルイミド(線膨張係数： $56 \times 10^{-6} / ^\circ\text{C}$ )が望ましい。キャリアハウジング47"の収容部47" Aの内周部は、図14(B)に示されるように、押圧用蓋52が装着されるとき、押圧用蓋52の外周部を案内し所定位置に位置決めするように形成されている。キャリアハウジング47"の収容部47" Aの底面部には、中央に開口部47" bが形成されている。開口部47" bの周辺の外面には、コンタクトシート45の孔45aにそれぞれ対応して位置決めピン47" Pが4箇所突出している。位置決めピン47" Pは、その底面に対して所定の長さ、例えば、コンタクトシート45の厚さ程度だけ突出している。位置決めピン47" Pは、コンタクトシート45のキャリアハウジング47"に対する相対位置を位置決めするとともに、キャリアハウジング47"の熱膨張または収縮の変位に応じてコンタクトシート45を同様に変位させるためのものとされる。キャリアハウジング47"の収容部47' Aのベース部材43"に対する相対位置は、融接のとき、位置決めされる。 20

## 【0088】

ベース部材43"は、キャリアハウジング47"の材料と同一材料により成形されている。 30

## 【0089】

斯かる例においても、転写板10と、ベース部材43"、キャリアハウジング47"およびコンタクトシート45とは、それぞれ、室温の温度上昇につれて膨張した場合においては、キャリアハウジング47"等の線膨張係数は、上述したように転写板10の線膨張係数よりも大に設定されているのでコンタクトシート45は、転写面10sとの相互間の摩擦力に抗して転写板10の伸びに比して相対的に大に延びることとなる。その結果、上述の第1の実施例と同様に、その表面粗さがより細かな粗さの凹凸が各バンプ45Bの先端に形成されることとなる。 40

## 【0090】

図15および図16は、それぞれ、本発明に係る電極の回復処理方法の第3の実施例に用いられるキャリアユニットステージの構成を、転写板固定ヘッドとともに概略的に示す。

## 【0091】

なお、図15および図16においては、図7および図8に示される例におけるキャリアユ 50

ニットにおいて同一とされる構成要素について同一の符号を付して示し、その重複説明を省略する。また、図15および図16においては、押圧用蓋が取り外された状態のキャリアユニットの一部の構成要素がキャリアユニットステージ内に保持された状態を示す。

【0092】

キャリアユニットは、その一部が図15および図17に示されるように、ベアチップ60が収容される収容部116Aを有するキャリアハウジング116と、キャリアハウジング116の収容部116Aの底部を形成するベース部材108上に弾性シート110を介して配されるコンタクトシート44と、ベアチップ60の電極群をコンタクトシート44のバンプ44Bに対して押圧する押圧体を含んでなる押圧用蓋と（不図示）、その押圧用蓋をキャリアハウジング116に選択的に保持するラッチ機構116Fとを含んで構成されている。 10

【0093】

なお、図示されていない上述の押圧用蓋は、図8に示される例における構成と同様な構成を備えている。

【0094】

ラッチ機構116Fは、図7に示されるようなキャリアハウジング116の両端にそれぞれ、支持軸により回動可能に支持され押圧用蓋の端部を保持するフック部材と、フック部材をそれぞれ、押圧用蓋の端部に係合させる方向に付勢するコイルスプリングと、を含んで構成されている。

【0095】

キャリアユニットステージ106は、コンタクトシート44のバンプ44Bの回復処理にあたり、キャリアハウジング116を一時的に収容する収容部106Aを有している。上方に向けて開口する収容部106Aの内周部は、図15および図17に示されるように、ベース部材108の収容部106Aに対する相対位置を規制するためにベース部材108の端部に係合するように形成されている。 20

【0096】

収容部106Aの周縁部には、図16および図17に示されるように、キャリアユニットのキャリアハウジング116を収容部106A内に着脱可能に保持する一対のラッチ機構が相対向して設けられている。そのラッチ機構は、キャリアユニットステージ106における収容部106Aを形成する壁部にそれぞれ、支持軸118により回動可能に支持されキャリアハウジング116の収容部116Aの周縁部を保持するフック部材112と、フック部材112をそれぞれ、収容部116Aの周縁部に係合させる方向に付勢するコイルスプリング114と、を含んで構成されている。 30

【0097】

フック部材112は、キャリアユニットのキャリアハウジング116だけが収容部106A内に装着されるとき、または、収容部106Aから取り外されるとき、図17に二点鎖線で示されるように、その一端がコイルスプリング114の付勢力に抗して収容部106A内から離隔するように回動される。一方、フック部材112の一端は、キャリアハウジング116が収容部106A内に保持されるとき、図15および図17に示されるように、コイルスプリング114の付勢力によりキャリアハウジング116の収容部116Aの周縁部に当接される。 40

【0098】

転写板固定ヘッドは、後述するように、バンプが摩耗したコンタクトシート44について回復処理が行なわれるとき、図15に示されるように、キャリアユニットにおけるキャリアハウジング116の収容部116A内に配置される。

【0099】

転写板固定ヘッドは、図15に示されるように、転写板104が固定される固定面102aを有する押圧体102と、押圧体102の基部を収容する凹部を有する蓋本体100と、押圧体102の基部の凹部と蓋本体100の比較的深い凹部との間の各空間にそれぞれ配され転写板104をコンタクトシート44のバンプ44Bに向けて付勢する複数のスプ 50

リング103とを含んで構成されている。

【0100】

押圧体102の基部は、蓋本体100の比較的浅く広い凹部内に移動可能に挿入されている。その押圧体102が挿入される部分の端部には、蓋本体100の下端に設けられる爪部に係合される爪部102nが相対向して複数個形成されている。これにより、押圧体102が複数のスプリング103の付勢力で付勢された状態で蓋本体100に保持されることとなる。

【0101】

金属材料またはセラミック材料等で作られる転写板104の一方の面は、固定面102aに対し接着または締結具により固定されている。転写板104の他方の面には、所定の平面度および所定の表面粗さを有した凹凸が形成されている。なお、転写板104は、斯かる例に限られることなく、押圧体102と一体に形成されてもよい。また、押圧体102は、複数のスプリング103が介在されることなく、例えば、蓋本体100と一体に形成されてもよい。

【0102】

一方、キャリアユニットの押圧用蓋（不図示）は、ベアチップ60に対し試験が実行されるとき、キャリアハウジング116にそのラッチ機構116Fにより保持される。

【0103】

蓋本体100の上部の略中央部には、後述するロードセルの雄ねじ部がはめ合わされる雌ねじ部100sが設けられている。

【0104】

図18は、コンタクトシート44のバンプ44Bについての回復処理の工程において、転写板固定ヘッドに対しコンタクトシート44を相対的に移動させる摺動装置の全体構成を概略的に示す。

【0105】

摺動装置は、ベース部材120上に配されコンタクトシート44が収容されるキャリアハウジング116を保持するキャリアユニットステージ106を固定するとともに所定の方向に移動させるテーブル機構部と、転写板固定ヘッドを保持し所定の圧力を転写板104およびコンタクトシート44のバンプ44Bに作用させる加圧機構部とを含んで構成されている。

【0106】

テーブル機構部は、ベース部材120上に配される基台122と、基台122に支持されるボールネジ部材124により移動されるX軸方向ステージ部材126と、ボールネジ部材124の軸線方向に略直交する方向に沿ってX軸方向ステージ部材126に支持されるボールネジ部材132により移動されるY軸方向ステージ部材130と、Y軸方向ステージ部材130に配されるステージ支持部134に回動可能に支持されキャリアユニットを保持する回転ステージ136とを含んで構成されている。

【0107】

基台122は、図18における矢印Xの示す方向に沿って形成される平坦部と、平坦部に対し略垂直に矢印Zの示す方向に広がり延在する倒立面部とからなる。

【0108】

X軸方向ステージ部材126は、ガイドレール168により案内され、かつ、ナットを介してボールネジ部材124により移動可能に支持されている。ボールネジ部材124の両端部は、それぞれ基台122の平坦部における図18において矢印Xの示す方向に沿った端部により支持されている。ボールネジ部材124の一方の端部には、遊星歯車機構等の減速機構160GHを介して基台122に固定される駆動モータ160の出力軸が連結されている。なお、駆動モータ160は、例えば、リニアモータ、ステッピングモータ、サーボモータ等が用いられても良い。駆動モータ160および後述する各駆動モータは、後述する制御ユニット150により制御される。

【0109】



Y軸方向ステージ部材130は、X軸方向ステージ部材126の内周部に一対対向配置されるガイドレール128Aおよび128Bにより紙面に垂直方向に沿って移動可能に支持されている。また、Y軸方向ステージ部材130は、ナットを介してボールネジ部材132により移動可能に支持されている。ボールネジ部材132の両端部は、それぞれX軸方向ステージ部材126における図18において紙面に垂直方向に沿った端部により支持されている。ボールネジ部材132の一方の端部には、遊星歯車機構等の減速機構を介してX軸方向ステージ部材126に固定される駆動モータ162の出力軸が連結されている。駆動モータ162は、例えば、リニアモータ、ステッピングモータ、サーボモータ等が用いられても良い。

【0110】

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Y軸方向ステージ部材130の上面に固定されるステージ支持部134の中央部には、駆動モータ164が固定されている。ステージ支持部134は、X軸方向ステージ部材126の切欠きを介してY軸方向ステージ部材130の上面に固定されている。駆動モータ164の出力軸には、減速機構164GHを介して回転ステージ136の円板部の中央の内側に連結されている。回転ステージ136の側壁は、ベアリング137を介して回転可能にステージ支持部134の上部に支持されている。駆動モータ164は、例えば、リニアモータ、ステッピングモータ、サーボモータ等が用いられても良い。

【0111】

これにより、回転ステージ136は、駆動モータ164が作動状態とされるとき、Y軸方向ステージ部材130の中心軸線およびステージ支持部134の中心軸線回りに回転されることとなる。

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【0112】

キャリアユニットステージ106は、図示が省略される締結部材、例えば、ねじ部材等により回転ステージ136の円板部に対し固定されている。

【0113】

加圧機構部は、転写板固定ヘッドを介してバンプ44Bに対する押圧力を検出するロードセル138と、ロードセル138を保持するとともに押圧力を転写板固定ヘッドに伝達するZ軸方向ステージ部材140と、Z軸方向ステージ部材140にはめ合わされ移動可能に支持するボールネジ部材142と、ボールネジ部材142を回転させる駆動モータ166とを含んで構成されている。

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【0114】

ボールネジ部材142の両端部は、それぞれ、倒立面部に所定の間隔をもって設けられる一対のブラケット部に回転可能に支持されている。ボールネジ部材142の一方の端部は、減速機構166GHを介して倒立面部に固定される駆動モータ166の出力軸に連結されている。駆動モータ166は、例えば、リニアモータ、ステッピングモータ、サーボモータ等が用いられても良い。

【0115】

Z軸方向ステージ部材140は、ナットを介してボールネジ部材142がその軸線に対し略垂直となるように嵌め合わされており、かつ、自転しないようにガイドレール144により案内されている。

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【0116】

ロードセル138は、内部のセンサ部に連結される雄ねじ部138sが転写板固定ヘッドの雌ねじ部100sにねじ込まれることにより、蓋本体100に連結されている。ロードセル138は、Z軸方向ステージ部材140の転写板固定ヘッドに対する押圧力を検出し押圧力をあらわす検出信号S<sub>p</sub>を制御ユニット150に送出する。

【0117】

制御ユニット150には、図示が省略される生産管理用のホストコンピュータからの各ステージ部材の位置を所定の基準位置に戻す命令をあらわすリセット指令信号S<sub>r</sub>、キャリアハウジング116の移動すべき方向をあらわす移動方向指令信号S<sub>d</sub>、回復処理開始指令信号S<sub>s</sub>、および、上述のロードセル138からの検出信号S<sub>p</sub>が供給される。

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## 【0118】

また、制御ユニット150は、コンタクトシート44に応じて設定される転写板固定ヘッドに対する押圧力の設定値、または、キャリアハウジング116（キャリアユニットステージ106）の移動量の設定値をあらわすデータ、回復処理を実行するためのプログラムデータ等が格納されるメモリ部150を内部に備えている。

## 【0119】

その押圧力の値は、バンプ44Bの大きさに応じて設定され、例えば、1つの電極あたり1g以上100g以下の範囲とされる。押圧力の値における下限の範囲の一例としては、1つの電極あたり1g以上40g以下の範囲とされる。

## 【0120】

キャリアハウジング116（キャリアユニットステージ106）の一方向の移動量は、各機構の遊びおよびコンタクトシート44の撓み等が加味され設定され、例えば、バンプ44Bの相対的な移動量が1 $\mu$ m以上1mm以下の範囲となるように設定される。バンプ44Bの相対的な移動量における下限の範囲の一例としては、1 $\mu$ m以上100 $\mu$ m以下の範囲とされる。

## 【0121】

本発明に係る電極の回復処理方法における第3の実施例による回復処理にあたり、先ず、図18に示されるように、バンプが摩耗したコンタクトシート44が配置されるキャリアハウジング116が取付けられたキャリアユニットステージ106が、所定の基準位置にある回転ステージ136の円板部に保持される。

## 【0122】

次に、制御ユニット150は、回復処理開始指令信号S<sub>s</sub>、移動方向指令信号S<sub>d</sub>およびメモリ部150内のデータに基づいてキャリアハウジング116およびキャリアユニットステージ106の移動量が所定の値となるように各ステージ部材の移動量を設定する。

## 【0123】

その際、制御ユニット150は、検出信号S<sub>p</sub>およびメモリ部150m内の押圧力の設定値のデータに基づいてZ軸ステージ140の移動量を設定する。

## 【0124】

制御ユニット150は、設定された移動量に応じてパルス制御信号C<sub>z</sub>を形成しモータ駆動回路158に供給する。モータ駆動回路158は、パルス制御信号C<sub>z</sub>に基づいて駆動信号を供給するものとされる。

## 【0125】

続いて、制御ユニット150は、設定された移動量に応じて少なくとも1回だけキャリアハウジング116およびキャリアユニットステージ106を移動させるべく、パルス制御信号C<sub>x</sub>、C<sub>y</sub>、C<sub>r</sub>を形成し、それぞれ、モータ駆動回路152、154、および156に供給する。モータ駆動回路152、154、および156は、それぞれ、パルス制御信号C<sub>x</sub>、C<sub>y</sub>、C<sub>r</sub>に基づいて駆動モータ160、162、および164に対し駆動信号を供給するものとされる。

## 【0126】

これにより、キャリアハウジング116内のコンタクトシート44のバンプ44Bは、転写板104に対して相対的に所定の方向に所定量だけ1回、移動せしめられることとなる。

## 【0127】

従って、上述の第1の実施例の場合と同様に比較的大きな押圧力を加えることなく、転写板104における転写面の微小な凹凸の押圧および摺動に対応した比較的微細な凹凸がバンプの摩耗した端部に形成されることとなる。その凹凸は、例えば、約0.1 $\mu$ m以上50 $\mu$ m以下程度の間隔で、約0.001 $\mu$ m以上5 $\mu$ m以下の高さで形成される。その凹凸の下限の範囲としては、例えば、約0.1 $\mu$ m以上50 $\mu$ m以下程度の間隔で、約0.002 $\mu$ m以上3 $\mu$ m以下の高さの範囲とされる。

## 【0128】

また、本実施例においては、第1の実施例の場合のように加熱する必要がないので回復処理における摺動量の制御が容易であり、かつ、比較的短期間で処理でき、その結果、より量産性に適している。

【0129】

そして、制御ユニット150は、押圧力を解除すべく、パルス制御信号C<sub>z</sub>を形成しモータ駆動回路158に供給する。

【0130】

回復処理されたコンタクトシートが収容されるキャリアハウジング116は、キャリアユニットステージ106から取り外される。その際、制御ユニット150は、供給される制御信号S<sub>r</sub>に基づいて各ステージ部材の位置を所定の基準位置に戻すべく制御パルス信号C<sub>x</sub>、C<sub>y</sub>、C<sub>r</sub>、およびC<sub>z</sub>を形成しそれらをモータ駆動回路152、154、156、158に供給する。

【0131】

取り外されたキャリアハウジング116は、ベアチップ60および押圧用蓋が装着された後、上述の例と同様にキャリアユニットとしてICソケット30の収容部に装着されることとなる。

【0132】

【発明の効果】

以上の説明から明らかなように、本発明に係る電極の回復処理方法によれば、第1の工程において電極部の接続面に載置された転写板を所定の圧力で電極部の接続面に向けて押圧しつつ、転写板および電極板を所定温度で所定期間、加熱するのでその膨張差によって相対的に摺動されることにより電極の接続面が所定の粗さに削られるので摩耗した電極板の電極部の接続面に容易にかつ確実に所定の凹凸を形成することができる。

【図面の簡単な説明】

【図1】(A)、(B)は、それぞれ、本発明に係る電極の回復処理方法の第1実施例の各工程を模式的に示す図である。

【図2】(A)は、図1(A)に示される工程におけるバンプの先端部が部分的に拡大して示され、各工程の説明に供される部分断面図であり、(B)は、図1(B)に示される工程におけるバンプの先端部が部分的に拡大して示され、各工程の説明に供される部分断面図である。

【図3】(A)、(B)、(C)、(D)は、それぞれ、本発明に係る電極の回復処理方法の第1実施例の各工程におけるバンプの先端部が部分的に拡大して示され、各工程の説明に供される部分断面図である。

【図4】(A)、(B)、(C)は、それぞれ、比較例の各工程におけるバンプの先端部が部分的に拡大して示され、比較例の各工程の説明に供される部分断面図である。

【図5】(A)、(B)、(C)は、それぞれ、バンプの先端が使用により摩耗していく各工程の説明に供される図である。

【図6】(A)、(B)、(C)は、それぞれ、バンプの先端が部分的に拡大されて示され、図5(A)、(B)、(C)に示されるバンプの先端が使用により摩耗していく各工程の説明に供される図である。

【図7】本発明に係る電極の回復処理方法の第1実施例および第2実施例が適用されるコンタクトシートを備える半導体装置用ソケットの一例を示す部分断面図である。

【図8】図7に示される例におけるキャリアユニットの構成を概略的に示す部分断面図である。

【図9】図8に示される例における平面図である。

【図10】(A)、(B)、(C)は、それぞれ、本発明に係る電極の回復処理方法の第2実施例の各工程の説明に供される要部を拡大して示す部分断面図である。

【図11】(A)、(B)、(C)は、それぞれ、図10(A)、(B)、(C)に示される図の一部を拡大して示す部分断面図である。

【図12】(A)は、本発明に係る電極の回復処理方法の第1実施例に用いられる他のキ



キャリアハウジングおよびベース部材の一例の構成を分解して示す構成図であり、(B)は、(A)におけるキャリアハウジングを含むキャリアユニットの構成を示す構成図である。

【図13】(A)は、本発明に係る電極の回復処理方法の第1実施例に用いられるさらなる他のキャリアハウジングおよびベース部材の一例の構成を分解して示す構成図であり、

(B)は、(A)におけるキャリアハウジングを含むキャリアユニットの構成を示す構成図である。

【図14】(A)は、本発明に係る電極の回復処理方法の第1実施例に用いられるさらなる他のキャリアハウジングおよびベース部材の一例の構成を分解して示す構成図であり、

(B)は、(A)におけるキャリアハウジングを含むキャリアユニットの構成を示す構成図である。 10

【図15】本発明に係る電極の回復処理方法の第3実施例に用いられるキャリアユニットステージの構成を転写板固定ヘッドとともに示す断面図である。

【図16】図15に示される例における平面図である。

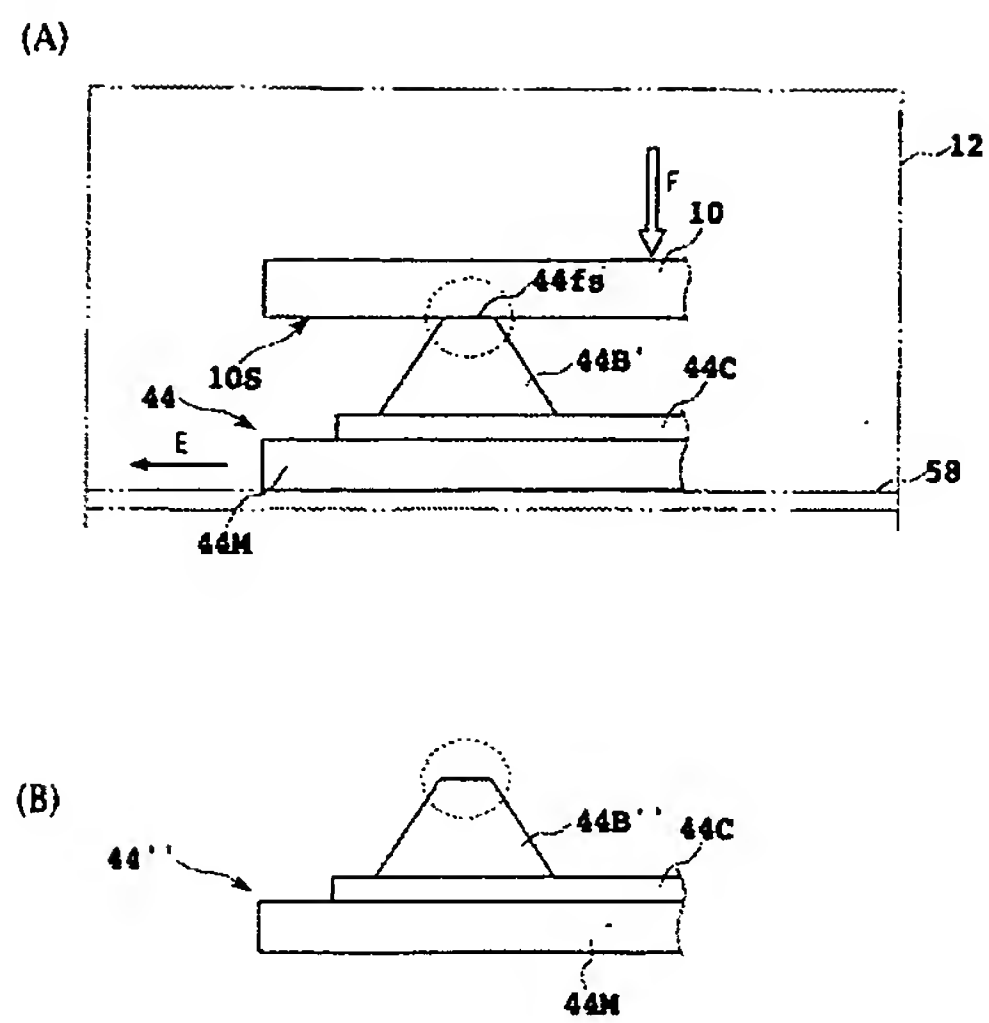
【図17】図15に示されるキャリアハウジングおよびキャリアユニットステージの構成を分解して示す構成図である。

【図18】本発明に係る電極の回復処理方法の第3実施例に用いられる摺動装置の全体構成を示す構成図である。

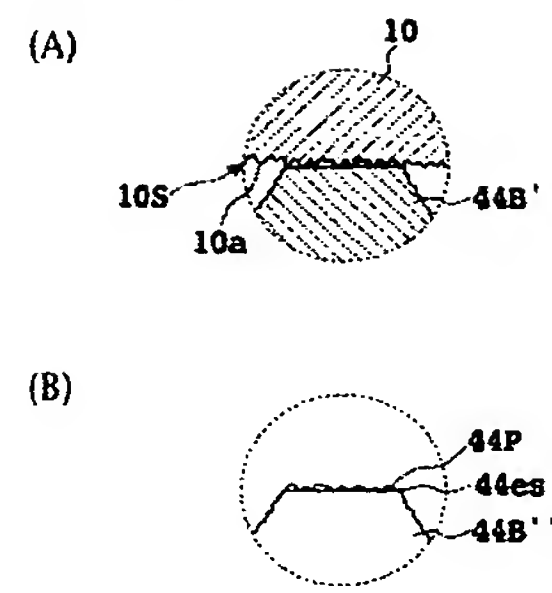
【符号の説明】

10a	凹凸	20
10、104	転写板	
10s	転写面	
12	恒温槽	
44、80	コンタクトシート	
44B、44B'、44B''、84B、84B'	バンプ	
44a、44ps、44ms、84a	凹凸	
44M、84M	基材	
60	ベアチップ	
86	結晶物	
126	X軸方向ステージ部材	30
130	Y軸方向ステージ部材	
136	回転ステージ	
140	Z軸方向ステージ部材	
160、162、164、166	駆動用モータ	

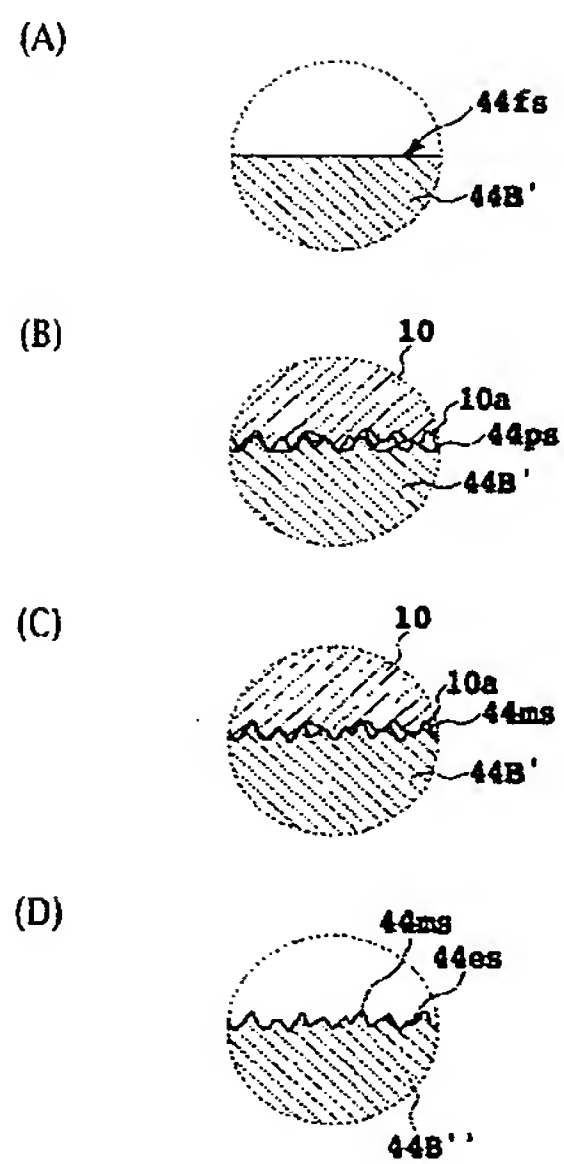
【図 1】



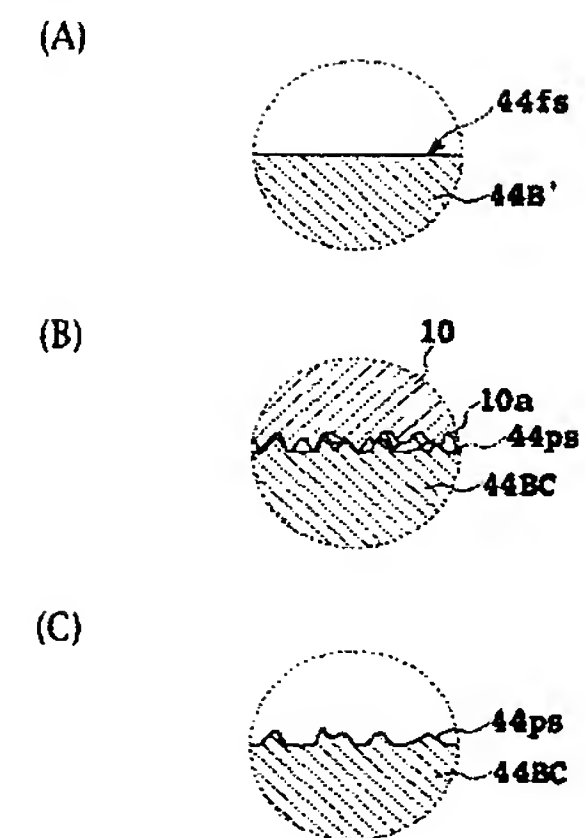
【図 2】



【図 3】

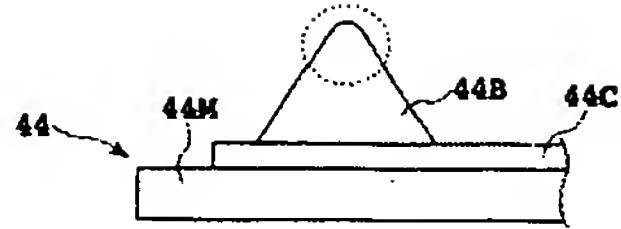


【図 4】

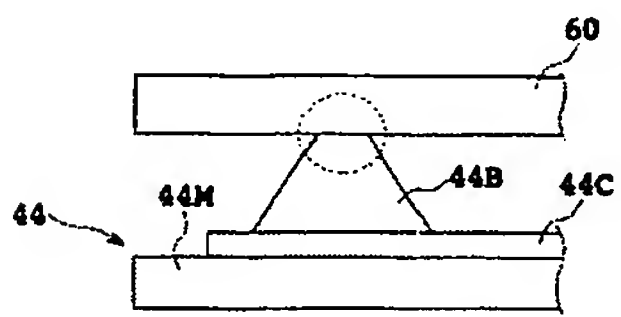


【図 5】

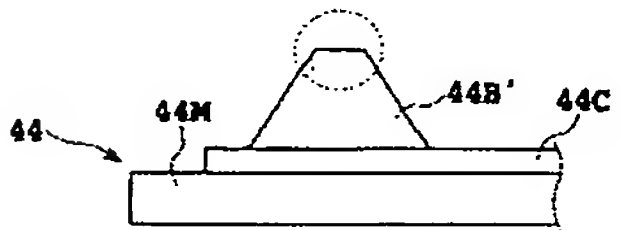
(A)



(B)

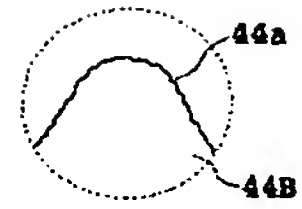


(C)

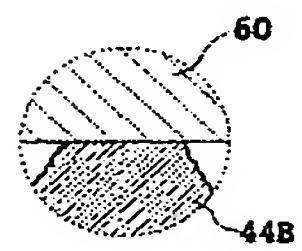


【図 6】

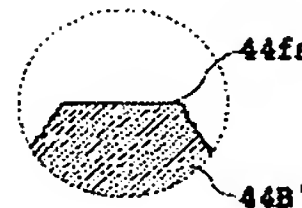
(A)



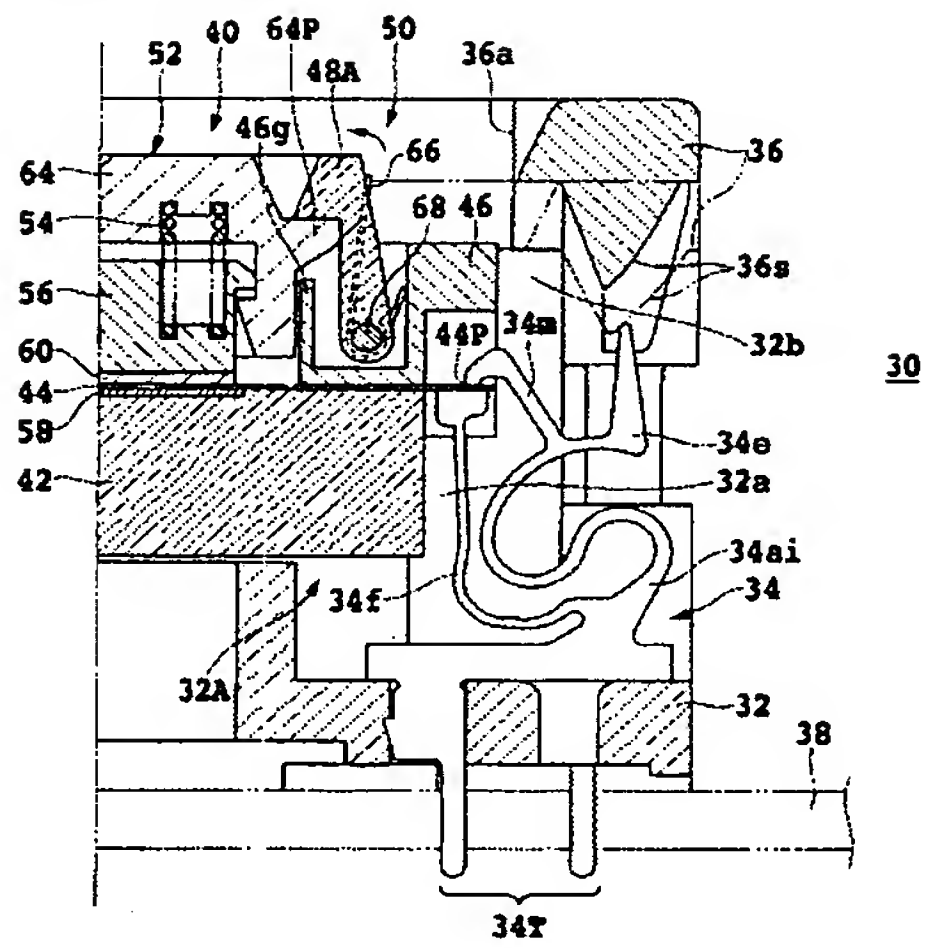
(B)



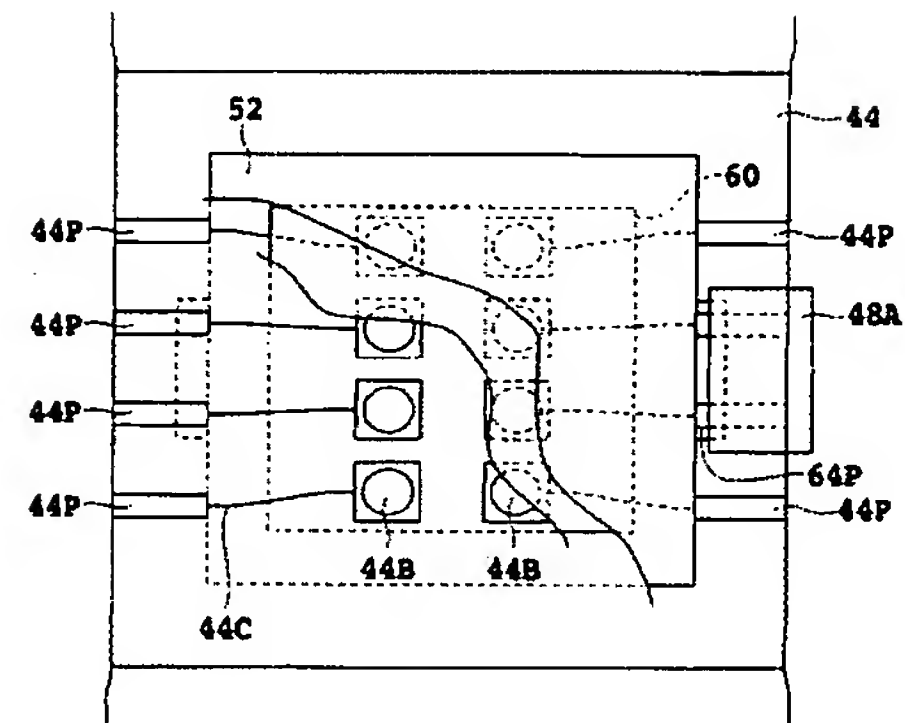
(C)



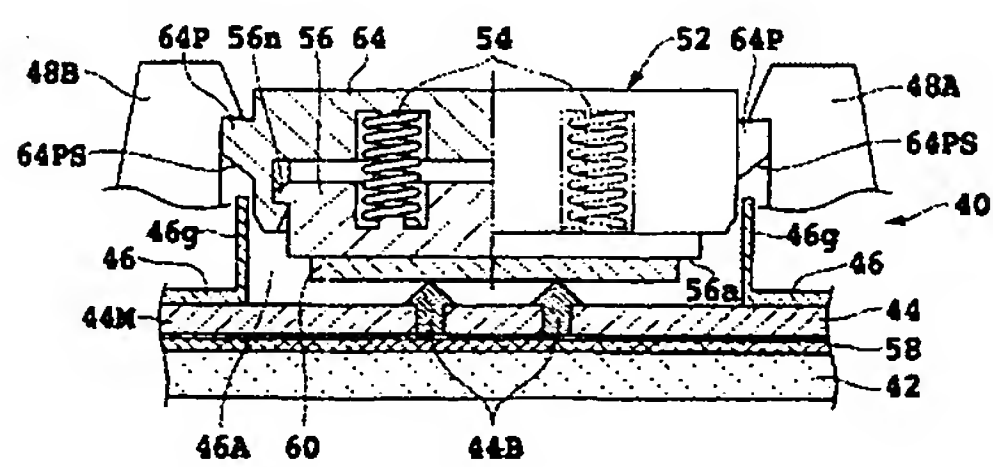
【図 7】



【図 9】



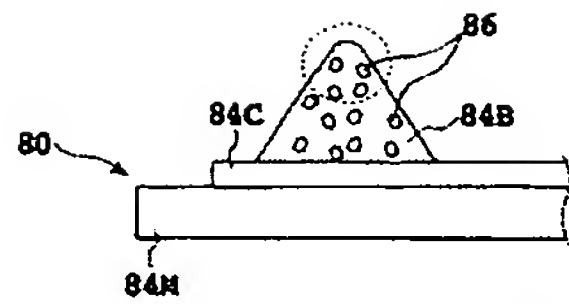
【図 8】



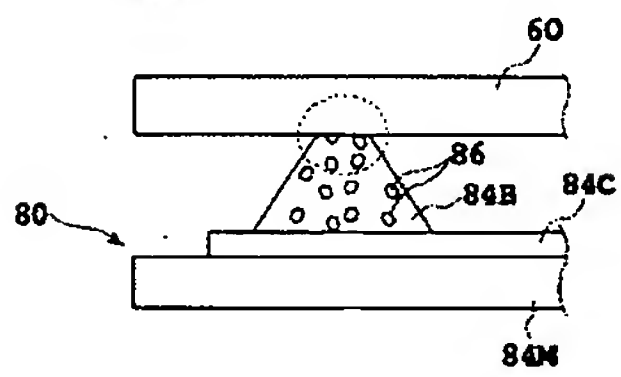


【図 10】

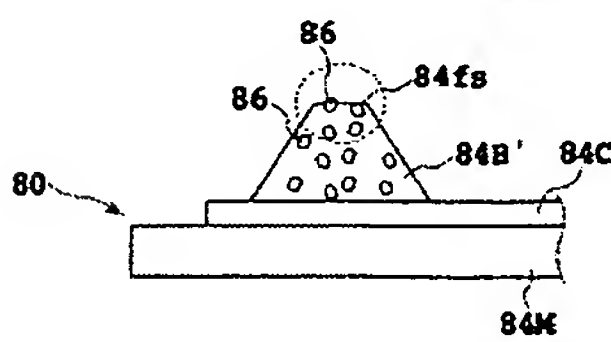
(A)



(B)

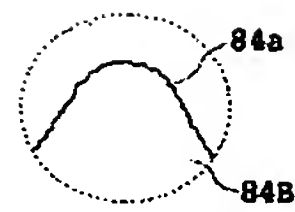


(C)

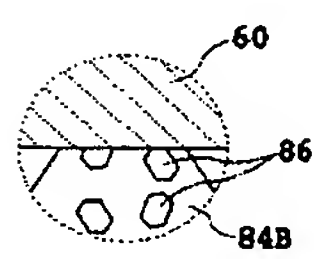


【図 11】

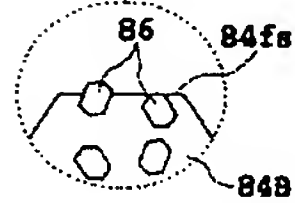
(A)



(B)

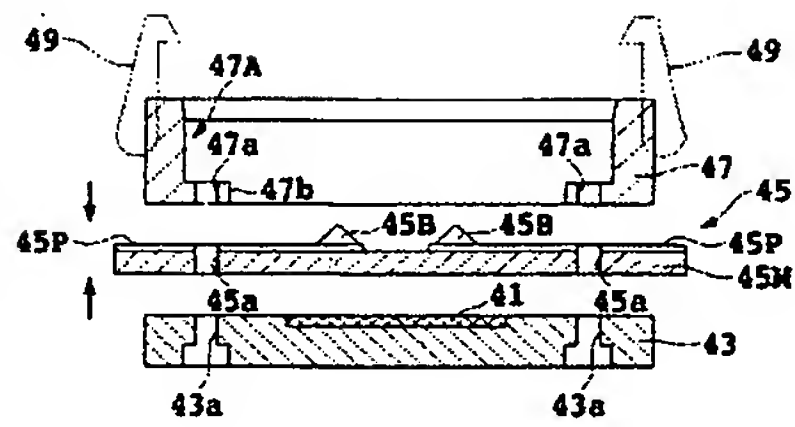


(C)

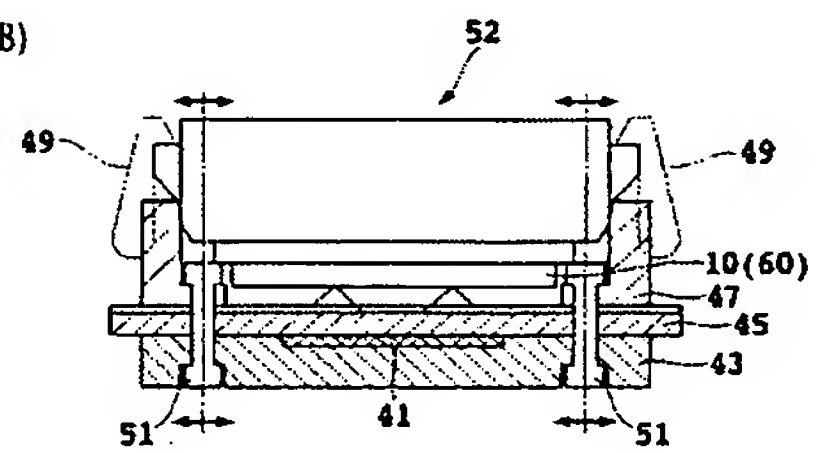


【図 12】

(A)

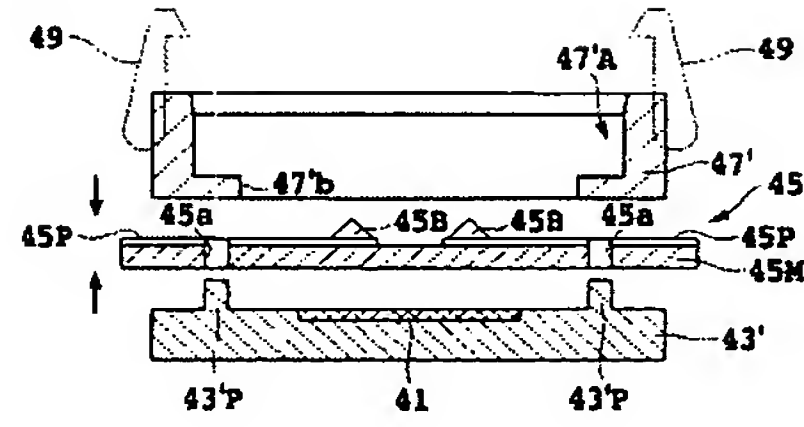


(B)

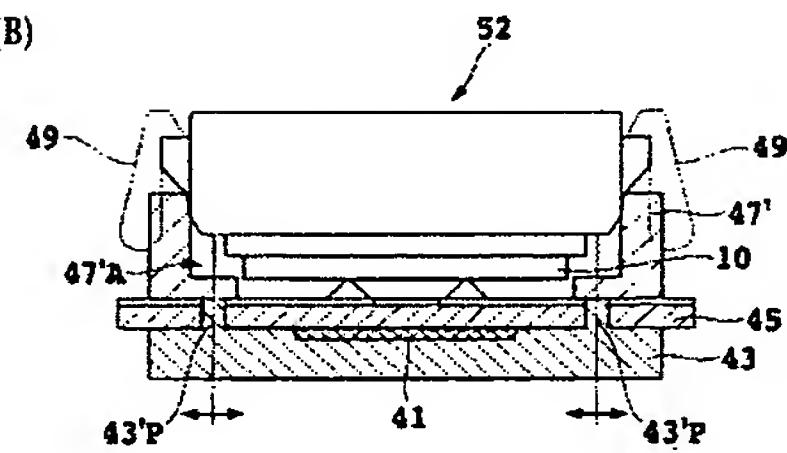


【図 13】

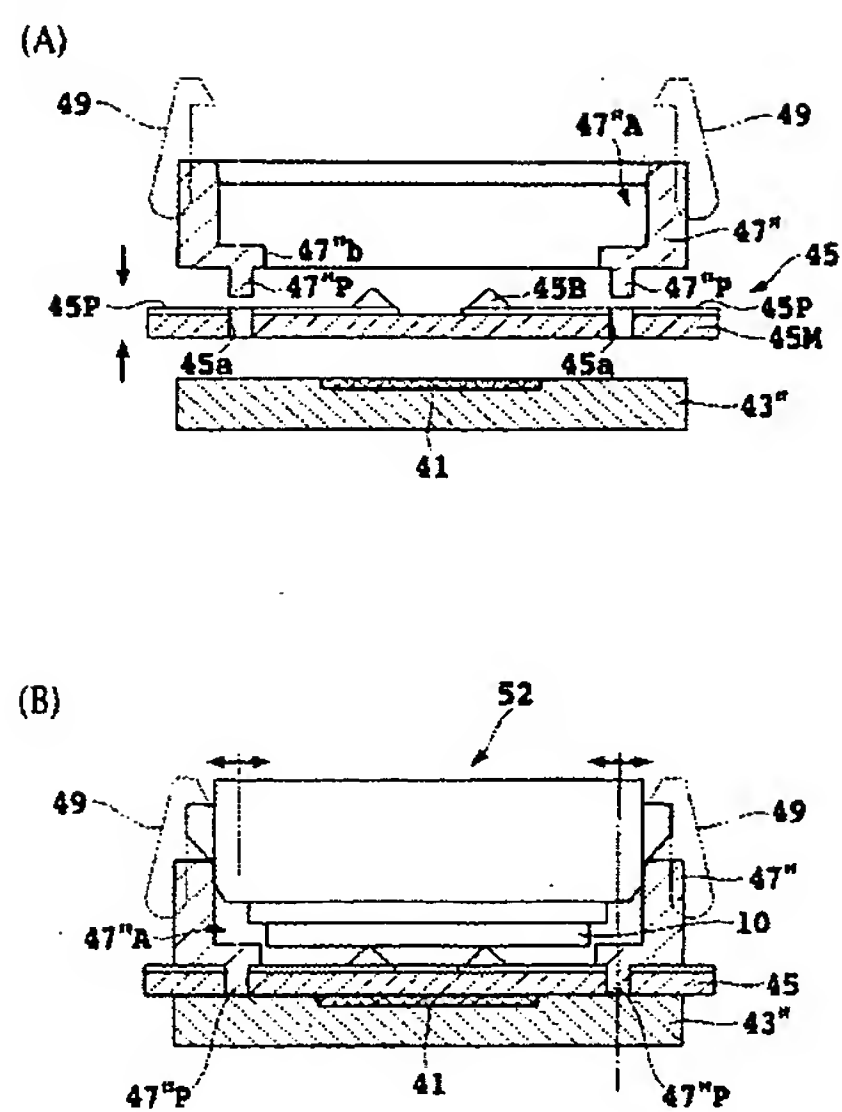
(A)



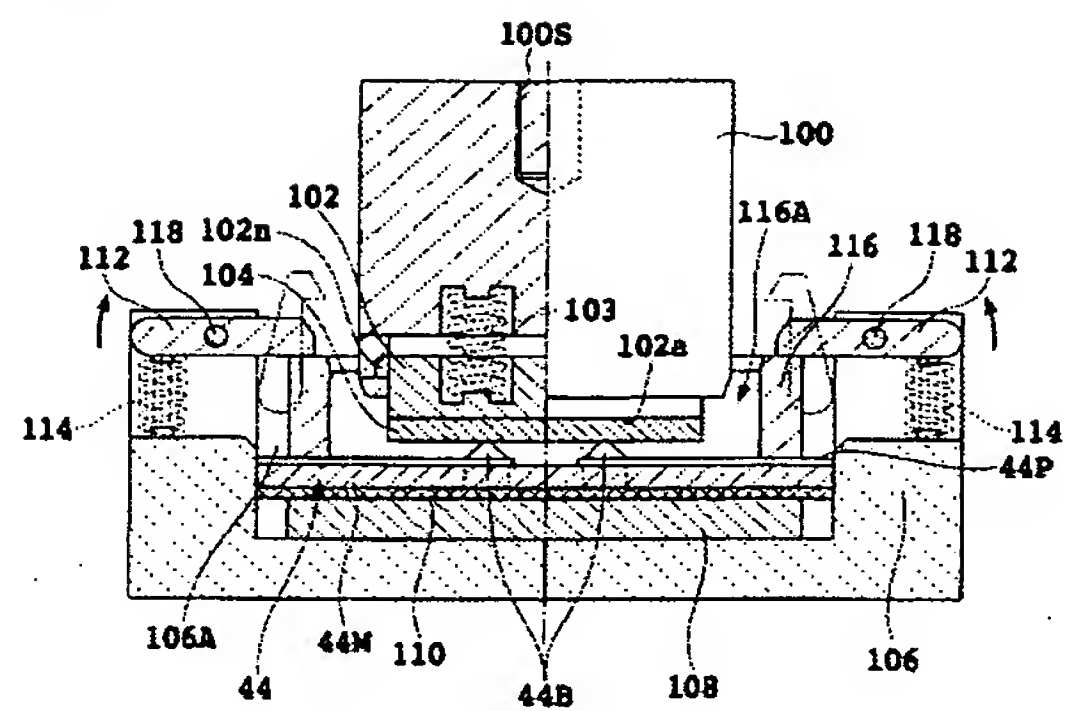
(B)



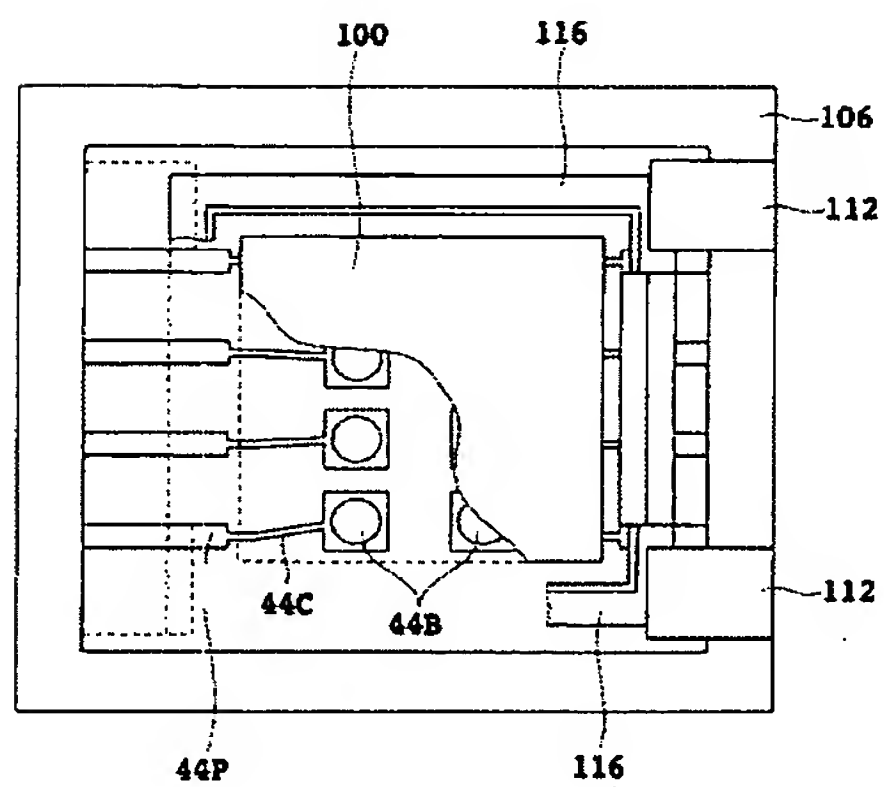
【図 14】



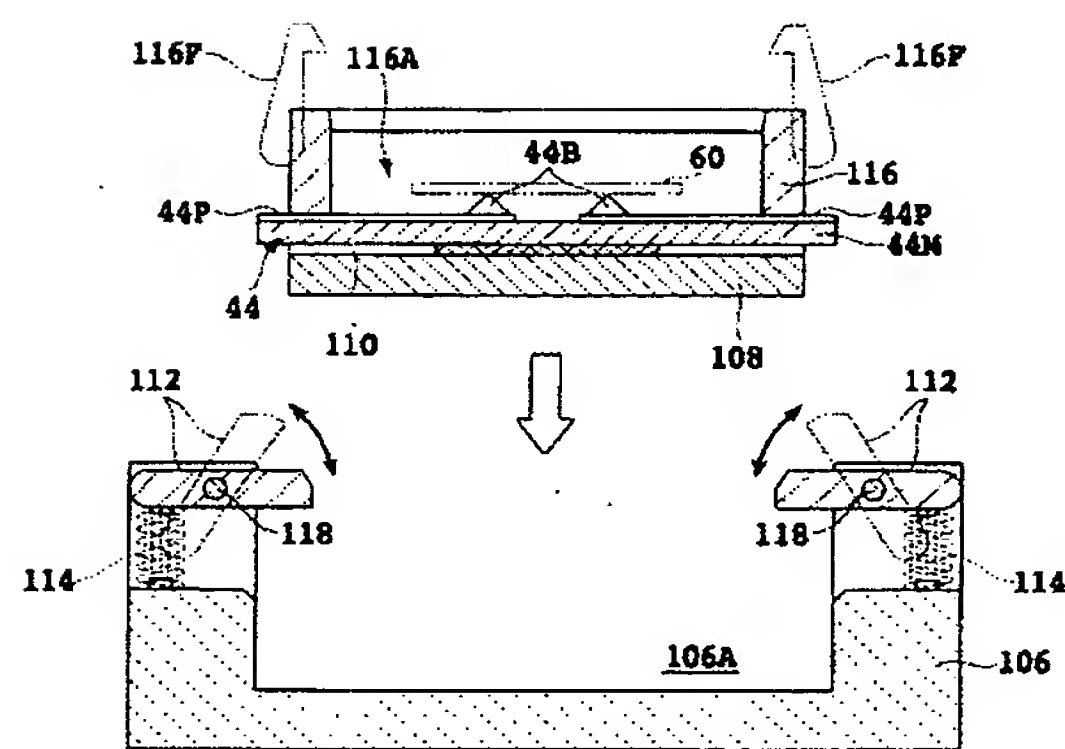
【図 15】



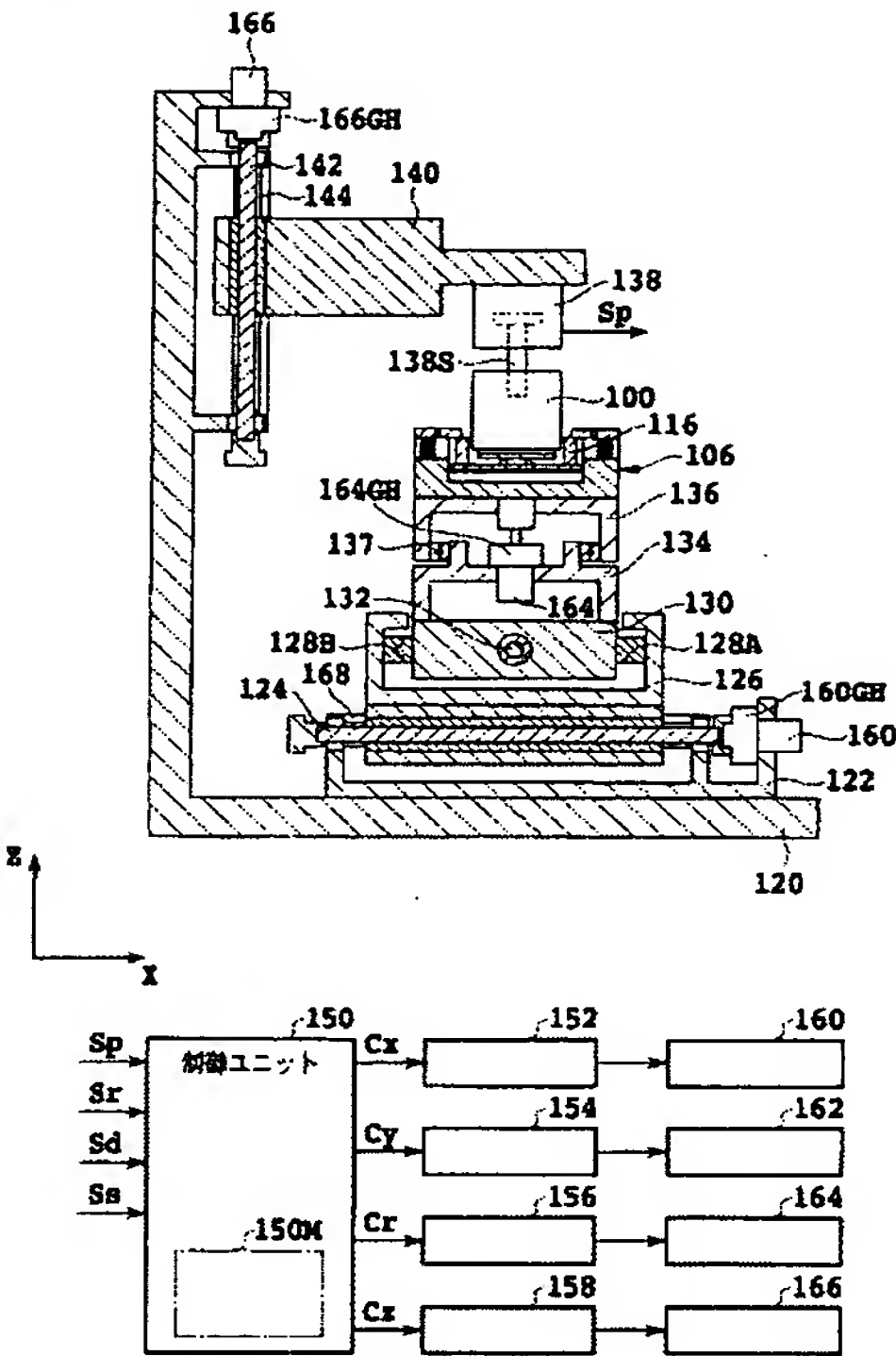
【図 16】



【図 17】



【図 18】





## PATENT ABSTRACTS OF JAPAN

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H01L 21/60  
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WAKABAYASHI YOSHINORI

(30)Priority

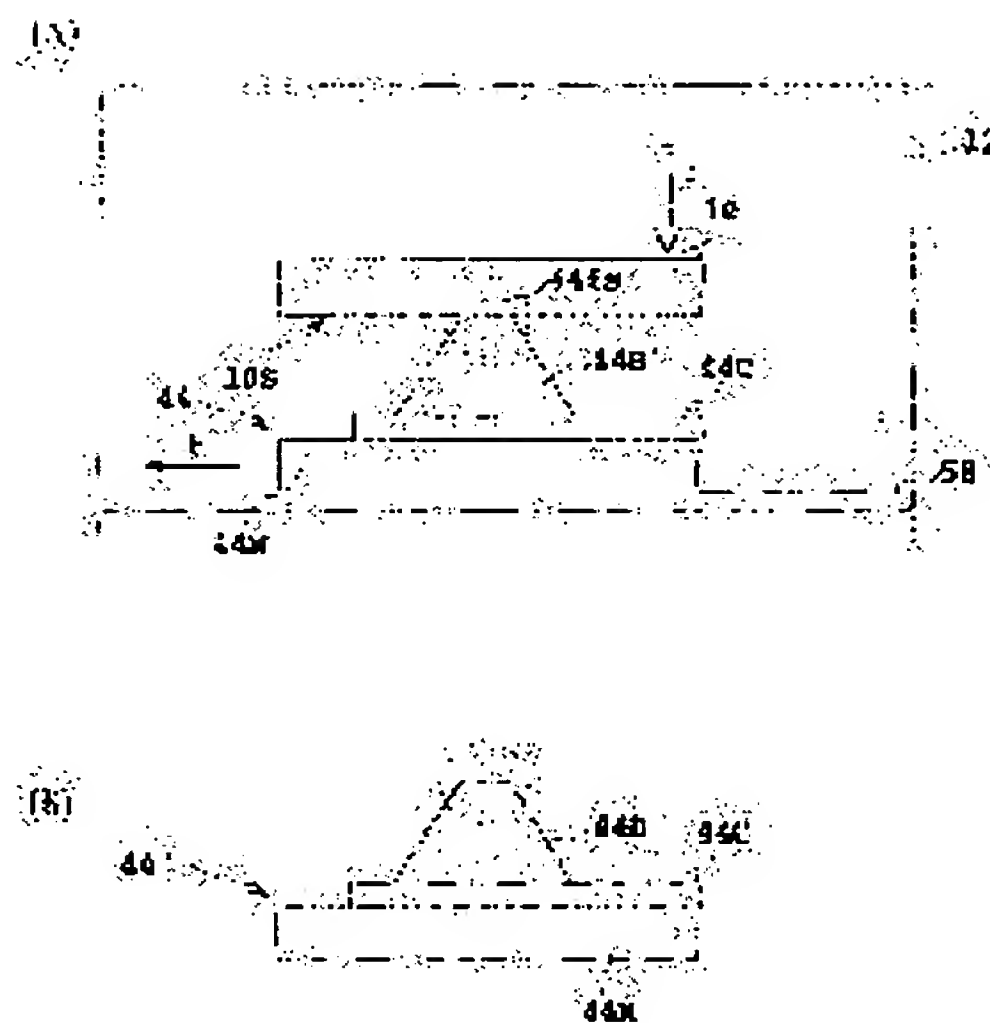
Priority number : 2002153062 Priority date : 27.05.2002 Priority country : JP

## (54) RECOVERY METHOD FOR ELECTRODE

(57)Abstract:

PROBLEM TO BE SOLVED: To facilitate and ensure the formation of predetermined roughness on the connecting surface of an electrode of a worn electrode plate.

SOLUTION: A transfer surface 10a of a transfer plate 10 having a predetermined transfer surface 10s with prescribed roughness is brought into contact, at predetermined pressure, with a plurality of bumps 44B on a contact sheet 44 which is formed on a substrate 44M having a linear expansion coefficient larger than that of the transfer plate 10. Simultaneously, the substrate 44M and the transfer plate 10 are heated to a predetermined temperature to recover the roughness of the connecting surface of the bump 44B at a predetermined level.



## LEGAL STATUS

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[Date of requesting appeal against examiner's  
decision of rejection]

[Date of extinction of right]

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- 3.In the drawings, any words are not translated.

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CLAIMS

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[Claim(s)]

[Claim 1]

The 1st process which lays this front face and this connection side of an imprint plate which have the polar zone formed on an insulating substrate, and have the front face where it is made from the ingredient of the coefficient of linear expansion of the insulating substrate of this electrode plate, and a different coefficient of linear expansion by the connection side of this polar zone in the electrode plate which performs electrical installation through the connection side of this polar zone to the terminal area of a semiconductor device, and irregularity is formed in it so that it may contact mutually,

They are a predetermined period and the 2nd process to heat at predetermined temperature about this imprint plate and said electrode plate, turning to the connection side of this polar zone the imprint plate laid in the connection side of said polar zone in said 1st process, and pressing it by the predetermined pressure,

The 3rd process which is made to isolate said imprint plate to said electrode plate, and obtains predetermined irregularity to the connection side of said polar zone,

The recovery approach of the electrode which becomes by \*\*\*\*\*,

[Claim 2]

The predetermined temperature and the predetermined period in said 2nd process are the recovery approach of the electrode according to claim 1 which is a temperature requirement from 80 degrees C or more to less than 150 degrees C, and is characterized by being set as the period for 15 or less minutes 5 minutes or more, respectively.

[Claim 3]

The 1st process which lays the terminal area of this semiconductor device in the connection side of this polar zone in the electrode plate which the polar zone which comes by specified quantity \*\*\*\* into this base material is formed on an insulating substrate in the minute crystal object which has the abrasion resistance which was excellent as compared with the abrasion resistance of a base material, and performs electrical installation through the connection side of this polar zone to the terminal area of a semiconductor device,

The 2nd process which obtains predetermined irregularity to this connection side by wearing this connection side, contacting the terminal area of said semiconductor device to the connection side of said electrode plate, and exposing said some of crystal objects,

The recovery approach of the electrode which becomes by \*\*\*\*\*,

[Claim 4]

Said crystal object is the recovery approach of the electrode according to claim 3 characterized by having the becoming degree of hardness and being made from PARAJUUMU or nickel with comparatively high electrical conductivity size from the degree of hardness of the copper which is said base material.

[Claim 5]

The 1st process which lays this front face and this connection side of an imprint plate which have the polar zone formed on an insulating substrate, and have the front face where irregularity is formed in the connection side of this polar zone in the electrode plate which performs



electrical installation through the connection side of this polar zone to the terminal area of a semiconductor device so that it may contact mutually,

They are the specified quantity and the 2nd process to which it is made to move relatively once [ at least ] to the direction of the gap which is not abbreviation parallel to this connection side about the connection side of this imprint plate or this polar zone, turning to the connection side of this polar zone the imprint plate laid in the connection side of said polar zone in said 1st process, and pressing it by the predetermined pressure,

The 3rd process which is made to isolate said imprint plate to said electrode plate, and obtains predetermined irregularity to the connection side of said polar zone,

The recovery approach of the electrode which becomes by \*\*\*\*\*.

[Claim 6]

The recovery approach of the electrode according to claim 5 characterized by making this electrode plate move to said imprint plate with the sliding equipment moved to abbreviation parallel to the connection side of said polar zone in said 2nd process, supporting said electrode plate.

[Claim 7]

The recovery approach of an electrode according to claim 1 or 5 that thrust in said 2nd process is characterized by being 1g or more per polar zone 100g or less.

[Claim 8]

The recovery approach of an electrode according to claim 5 that the specified quantity of the relative migration in said 2nd process is characterized by 1-micrometer or more being 1mm or less.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

#### [Field of the Invention]

This invention relates to the recovery approach of an electrode that the connection side of the polar zone of an electrode plate which has the polar zone which performs electrical installation to the terminal of a semiconductor device can be recovered so that it may become predetermined surface roughness.

[0002]

#### [Description of the Prior Art]

In the IC socket for electronic equipment, or a connector, it is requested that the terminal of the semiconductor device with which the electrode of the substrate for wiring is equipped is generally connected certainly electrically. In such equipment, as shown also in JP,8-96865,A and JP,2000-294043,A, forming by etching processing is proposed [ projection / thermal spraying or / minute ] in ceramic-flame-spraying coats enough in order to break through the oxide skin formed in the terminal at the electric contact section of the conductor pattern to which the terminal (electrode) of a semiconductor device is connected electrically, or the end face of a track, for example. Thus, by forming a minute projection in the electric contact section or the end face of a track, since a mutual touch area is reduced and the contact pressure per unit area increases, the effectiveness that an oxide skin is easy to be destroyed will be done so.

[0003]

Consequently, the terminal of a semiconductor device will be electrically connected to the electrode of the substrate for wiring certainly.

[0004]

#### [Problem(s) to be Solved by the Invention]

In the above IC sockets for electronic equipment, when the electric contact section of a conductor pattern is used repeatedly, since there is a fixed life also in the endurance of the minute projection which has the above abrasion resistance, and a ceramic-flame-spraying coat, a minute projection will be worn out with contact pressure etc. therefore, abbreviation which does not have irregularity, without recovering the electric contact section or the end face of a track according to operating frequency — since it becomes a flat front face, there is a possibility that a touch area may increase and contact pressure may become inadequate. Consequently, the positive electric connection obtained at the beginning may not no longer be obtained as it uses it.

[0005]

It is the recovery approach of an electrode that the connection side of the polar zone of an electrode plate which has the polar zone to which this invention performs electrical installation to the terminal of a semiconductor device in consideration of the above trouble can be recovered so that it may become predetermined surface roughness, and aims at offering the recovery approach of the electrode which can form easy and, certainly predetermined irregularity to the connection side of the polar zone of the worn-out electrode plate.

[0006]

[Means for Solving the Problem]

In order to attain the above-mentioned purpose, the recovery approach of the electrode concerning this invention To the connection side of the polar zone in the electrode plate which has the polar zone formed on an insulating substrate, and performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device The 1st process which lays the front face and connection side of an imprint plate which have the front face in which it is made from the ingredient of the coefficient of linear expansion of the insulating substrate of an electrode plate, and a different coefficient of linear expansion, and irregularity is formed so that it may contact mutually, Turning to the connection side of the polar zone the imprint plate laid in the connection side of said polar zone in the 1st process, and pressing it by the predetermined pressure A predetermined period, the 2nd process to heat, and an imprint plate are made to isolate an imprint plate and this electrode plate to said electrode plate at predetermined temperature, and it comes to contain the 3rd process which obtains predetermined irregularity to the connection side of the polar zone.

[0007]

Moreover, the 2nd predetermined temperature and predetermined period in a process are a temperature requirement from 80 degrees C or more to less than 150 degrees C, and may be set as the period for 15 or less minutes 5 minutes or more, respectively.

[0008]

Furthermore, the recovery approach of the electrode concerning this invention The polar zone which comes by specified quantity \*\*\*\* into a base material is formed on an insulating substrate in the minute crystal object which has the abrasion resistance which was excellent as compared with the abrasion resistance of a base material. The 1st process which lays the terminal area of a semiconductor device in the connection side of the polar zone in the electrode plate which performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device, It comes to contain the 2nd process which obtains predetermined irregularity to a connection side by wearing a connection side, contacting the terminal area of a semiconductor device to the connection side of an electrode plate, and exposing some crystal objects.

[0009]

A crystal object has the degree of hardness which consists of a degree of hardness of the copper which is a base material size, and may be made from PARAJUUMU or nickel with comparatively high electrical conductivity.

[0010]

The recovery approach of the electrode concerning this invention further again To the connection side of this polar zone in the electrode plate which has the polar zone formed on an insulating substrate, and performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device The 1st process which lays the front face and connection side of an imprint plate which have the front face in which irregularity is formed so that it may contact mutually, Turning to the connection side of the polar zone the imprint plate laid in the connection side of the polar zone in the 1st process, and pressing it by the predetermined pressure To a connection side, it shifts and comes to include an imprint plate or the connection side of the polar zone the 3rd process without abbreviation parallel which obtains irregularity predetermined to the connection side of the polar zone once [ at least ] in that direction by making the specified quantity, the 2nd process to which it is made to move relatively, and an imprint plate isolate to an electrode plate.

[0011]

Moreover, an electrode plate is made to move to an imprint plate in the 2nd process with the sliding equipment moved to abbreviation parallel to the connection side of the polar zone, supporting an electrode plate.

[0012]

The thrust in the 2nd process may be 1g or more per polar zone 100g or less, and the specified quantity of the relative migration in the 2nd process may be 1 micrometers or more 1mm or less.

[0013]

[Embodiment of the Invention]

Drawing 7 shows the socket for semiconductor devices equipped with the electrode plate for connection with which the 1st example, 2nd example mentioned later, and 3rd example of the recovery approach of the electrode concerning this invention are applied.

[0014]

In the socket for semiconductor devices shown in drawing 7, it considers as the electrical-characteristics trial of a semiconductor device, and the thing specifically used for a burn in test etc., for example. The socket for semiconductor devices is constituted including the carrier unit 40 by which the bare chip as a semiconductor device is held in the interior, and IC socket 30 with which the hold section is equipped with the carrier unit 40 removable.

[0015]

The body section 32 which has the hold section which IC socket 30 is arranged on the printed-circuit board 38 which outputs and inputs the inspection signal to a bare chip, the detection output signal from a bare chip, etc., and holds the carrier unit 40, The contact group 34 which consists of two or more contacts electrically connected to each pad of the contact sheet as an electrode plate for connection which is formed in the body section 32 and serves as a component in the carrier unit 40, and which is mentioned later, respectively, The covering member 36 which is allotted possible [ a vertical movement ] to the body section 32, and connects each contact surface of the contact group 34 to each pad of a contact sheet electrically alternatively is constituted as main elements.

[0016]

The body section 32 fabricated with a resin ingredient is arranged in the predetermined location corresponding to the polar zone of a printed-circuit board 38. The body section 32 has hold section 32A in which the carrier unit 40 is held, as shown in drawing 7. Hold section 32A is surrounded by the inner circumference section of lower pedestal 32a which engages with the lower part of the base section of the carrier unit 40 mentioned later, and the inner circumference section of up pedestal 32b which stands in a row in lower pedestal 32a, and engages with the upper part of the base section, and is formed. The contact group 34 is supported by lower pedestal 32a. the contact group 34 is constituted in lower pedestal 32a and up pedestal 32b — each — the slit in which contact 34ai ( $i=1-n$  and  $n$  integer) is inserted is formed.

[0017]

each — contact 34ai ( $i=1-n$  and  $n$  integer) 34f of fixed side contact surfaces which stand in a row in terminal area 34T currently pressed fit in lower pedestal 32a, and terminal area 34T, and are electrically connected to the pad of a contact sheet from a lower part side, 34m of movable side contact surfaces which have elasticity, stand in a row in terminal area 34T, and are electrically connected to the pad of a contact sheet from an upper part side, It engages with the slant surface part of the covering member 36 which branches from 34m of movable side contact surfaces, and is mentioned later alternatively, and is constituted including engaged portion 34e which rotates 34m of movable side contact surfaces in the direction isolated to 34f of fixed side contact surfaces.

[0018]

each — contact 34ai is arranged at the predetermined spacing along the abbreviation perpendicular direction in drawing 7 to space corresponding to the pad of the contact sheet 44 mentioned later. In addition, in drawing 7, the contact group 34 of only the part corresponding to one side in the contact group 34 which encloses the four way type of hold section 32A is shown.

[0019]

The covering member 36 fabricated with a resin ingredient has opening 36a which the carrier unit 40 passes. A part for the frame which forms the periphery of opening 36a is supported possible [ a vertical movement ] by the leg guided in the slot established in the periphery section of the body section 32. In addition, the covering member 36 is energized in the direction isolated to the body section 32 by the elastic member to which illustration is abbreviated. the time of the



covering member 36 being made to descend to the lower limit of each side for the frame to a predetermined location, as shown by the NI point chain line of drawing 7 -- a \*\*\*\* -- each -- it engages with engaged portion 34e of contact 34ai, and 36s of slant surface parts which rotate 34m of movable side contact surfaces in the direction which resists the elastic force and is isolated to 34f of fixed side contact surfaces is formed, respectively.

[0020]

When hold section 32A of the body section 32 of IC socket 30 is equipped with the carrier unit 40 mentioned later, after the covering member 36 is made to retreat to hold section 32A the specified quantity and by carrying out depression maintenance in 34m of each traveling contact section of the contact group 34, the carrier unit 40 is positioned and laid in hold section 32A through opening 36a from the upper part. 34f of fixed side contact surfaces is made to contact the inferior-surface-of-tongue side of the pad of the contact sheet 44 in the carrier unit 40 in that case.

[0021]

then, the time of the covering member 36 in the condition of having been held being released -- the return force of an above-mentioned elastic body -- and -- each -- the covering member 36 is made to go up by resultant force of the elastic force of engaged portion 34e of contact 34ai 34m of each traveling contact section of the contact group 34 is returned to the original location, and it is made to contact the top-face side of the pad of the contact sheet 44 of the carrier unit 40 in that case. By that cause, as shown in drawing 7, the contact sheet 44 and the contact group 34 will be connected electrically.

[0022]

The carrier housing 46 which has hold section 46A in which a bare chip 60 is held as the carrier unit 40 is shown in drawing 8, The contact sheet 44 arranged through the elastic sheet 58 on the base member 42 which forms the pars basilaris ossis occipitalis of hold section 46A of the carrier housing 46, It is constituted including the lid 52 for press which comes to contain the press object 56 which presses the electrode group of a bare chip 60 to bump 44B of the contact sheet 44, and the ratchet mechanism 50 (refer to drawing 7) which holds the lid 52 for press alternatively in the carrier housing 46.

[0023]

As shown in drawing 8, the lid 52 for press is arranged on the space between the press object 56 which has press side 56a which contacts the top face of a bare chip 60, the body 64 of a lid which holds the base of the press object 56, and the crevice of the base of the press object 56 and the comparatively deep crevice of the body 64 of a lid, and is constituted including two or more springs 54 which turn the press object 56 to a bare chip 60, and energize it.

[0024]

The bare chip 60 of an abbreviation square has the predetermined electrode group on the inferior surface of tongue which counters the bump of the contact sheet 44.

[0025]

The base of the press object 56 is inserted movable into the comparatively shallow large crevice of the body 64 of a lid. 56n of claw parts which engage with the claw part prepared in the lower limit of the body 64 of a lid carries out phase opposite, and they are formed in the edge of a part at which the press object 56 is inserted. [ two or more ] By this, the press object 56 will be held in the condition of having been energized by the energization force of a spring 54 at the body 64 of a lid.

[0026]

The body 64 of a lid has height 64p to which the hook members 48A and 48B of a ratchet mechanism 50 engage with the both ends which counter, respectively. At the time of wearing of the lid 52 for press, height 64p engages with the inclined plane at the tip of the hook members 48A and 48B, and has slant surface part 64ps which presses the hook members 48A and 48B in the direction isolated mutually so that it may mention later.

[0027]

The hook members 48A and 48B which a ratchet mechanism 50 is supported by the both ends of the carrier housing 46 rotatable, respectively, and hold the body 64 of a lid, The torsion coiled

spring 66 energized in the direction where an arrow head shows the hook members 48A and 48B in drawing 7, respectively, i.e., the direction made to engage with height 64p of the body 64 of a lid. It is constituted including the hook members 48A and 48B and the support shaft 68 which supports the torsion coiled spring 66.

[0028]

When equipped with the lid 52 for press, 46g of guide sections to which it shows the periphery section of the lower part of the body 64 of a lid is formed in the both ends of the carrier housing 46. The both ends of the support shaft 68 are supported around 46g of guide sections.

[0029]

The contact sheet 44 has two or more bump 44B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 44M, as shown in drawing 8 and drawing 9. For example, only height predetermined [ front face / of the copper used as a base material / the front face of base material 44M to ] in nickel and the tip of each bump 44B which gold plate processing is carried out and is formed is projected. Base material 44M are made for example, from a polyimide resin ingredient (coefficient of linear expansion:  $35 \times 10^{-6} / \text{degree C}$ ) in the shape of sheet metal, and have the thickness of about 40 micrometers.

[0030]

Each bump 44B is connected to pad 44p through conductor-layer 44c made from copper foil, as shown in drawing 9. Pad 44p is formed in the both ends which project towards the exterior from the both ends of the base member 42 in base material 44M, respectively.

[0031]

In addition, only the predetermined range is supported relatively [ front face / of the base member 42 ] movable to abbreviation parallel by the part in which two or more bump 44B which can be set on the contact sheet 44 is formed.

[0032]

In this configuration, in equipping with a bare chip 60 in the carrier unit 40, first, the electrode group of a bare chip 60 is positioned to bump 44B of the contact sheet 44, and it is arranged so that the electrode group of a bare chip 60 may contact bump 44B. Next, the lid 52 for press is inserted into hold section 46A of the carrier housing 46. It rotates in the direction which resists the energization force of the torsion coiled spring 66, and the tip of the hook members 48A and 48B of a ratchet mechanism 50 isolates mutually by slant surface part 64ps of the body 64 of a lid of the lid 52 for press in that case. Moreover, the peripheral face of the body 64 of a lid being guided at the inside which is 46g of guide sections, press side 56a of the press object 56 resists the energization force of a spring 54, and is forced on the top face of a bare chip 60.

[0033]

Then, by being energized from the torsion coiled spring 66, the tip of the hook members 48A and 48B rotates in the direction which approaches mutually, and engages with height 64p of the body 64 of a lid. Consequently, the lid 52 for press will be held at the carrier housing 46.

[0034]

And as the carrier unit 40 mentioned above, where hold section 32A is equipped, a trial will be performed in a predetermined ambient atmosphere to a bare chip 60.

[0035]

Repeat use of the above contact sheets 44 will be carried out in such a trial to the new bare chip 60 with which it is equipped with a predetermined number.

[0036]

Before presenting such a trial, each bump 44B has the approximate circle drill-like configuration so that it may be expanded to drawing 5 (A) and may be shown at the beginning. Moreover, as the latest section of bump 44B is expanded and it is shown in it at drawing 6 (A), minute concavo-convex 44a is formed in the whole front face.

[0037]

Next, the latest section of bump 44B will have predetermined crushing cost, and will be contacted by the electrode surface of a bare chip 60 by the predetermined pressure so that it may be expanded to drawing 5 (B) and drawing 6 (B) and may be shown, when a trial is presented with the contact sheet 44.

[0038]

Then, by carrying out repeat use of the contact sheet 44 of one sheet to the bare chip 60 of a predetermined number, the latest section of each bump 44B' is crushed, and serves as the approximate circle frustum configuration of having a flat side so that it may be expanded to drawing 5 (C) and drawing 6 (C) and may be shown. Flatness side 44fs with such each smooth bump 44B' does not have minute irregularity as shown in drawing 6 (A).

[0039]

Therefore, when used more than the count of predetermined, without being exchanged in the contact sheet 44 of one sheet, there is a possibility that the electrical installation the contact sheet 44 and between bare chip 60 may become uncertain.

[0040]

Then, in the 1st example of the recovery approach of the electrode concerning this invention, the imprint plate 10 which has predetermined thickness as shown in drawing 1 (A) beforehand is prepared. The imprint plate 10 is made from the tool steel between the colds (JIS notation SKS, SKD) (coefficient of linear expansion: about  $11.5 \times 10^{-6}$ /degree C) which carried out plating processing as surface treatment with chromium (coefficient of linear expansion: about  $6.2 \times 10^{-6}$ /degree C), and at least, as it is expanded to drawing 2 (A) and shown in 10s of imprint sides of one side, it has concavo-convex 10a of predetermined granularity.

[0041]

First, as shown in drawing 1 (A), while the contact sheet 44 with which the bump was worn out is arranged, the above-mentioned carrier unit 40 equipped with the imprint plate 10 instead of the bare chip 60 is arranged in the thermostat 12 which maintains whenever [ predetermined room air temperature ]. It shall have a thermostat 12 in the heat regulator which can adjust indoor temperature to adjustable.

[0042]

The imprint plate 10 is laid on the common flat surface formed of two or more flatness side 44fs (es) so that 10s of the imprint side may contact flatness side 44fs in which each bump 44B' in a thermostat 12 was worn out in that case. Therefore, the imprint plate 10 will be supported by flatness side 44fs of two or more bump 44B'. It is pressurized by the energization force of a spring 54 by the predetermined pressure along the direction which the arrow head F shown in drawing 1 (A) shows through the press object 56 in that case. The welding pressure is set as the range of one bump 44B per 1g or more abbreviation [ 100g or less ]. When it is less than 1g of bump 44B per abbreviation whose welding pressure is one piece according to verification by the artificer of this application, per [ whose welding pressure there is almost no effectiveness of recovery and is one piece / bump 44B ], when exceeding 100g, and the protrusion height of bump 44B becomes lower than criteria too much and crushing of the tip of bump 44B serves as size comparatively Since it was checked that the problem of exerting comparatively big damage on the electrode of an inspected object arises, the welding pressure is set as the range of one bump 44B per 1g or more abbreviation [ 100g or less ].

[0043]

Drawing 3 (B) expands the condition of the point of bump 44B' immediately after 10s of imprint sides having contacted flatness side 44fs, and pressurizing them, and is shown. By this, the point of bump 44B' will be pressed by concavo-convex 10a of the imprint plate 10, and comparatively coarse concavo-convex 44ps will be formed so that clearly from drawing 3 (B).

[0044]

Next, the temperature in a thermostat 12 is made to go up by the range from reference condition to [ from 80 degrees C or more ] 150 degrees C, and is maintained 5 minutes or more. In addition, the temperature and the period to maintain in a thermostat 12 are preferably set up in about 15 minutes at the room temperature of 150 degrees C.

[0045]

Therefore, the imprint plate 10 and the contact sheet 44 [ when it expands in the direction which the arrow head E of drawing 1 (A) shows along with the temperature rise of a room temperature, respectively ] Since the coefficient of thermal expansion of base material 44M is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the



contact sheet 44 will resist mutual frictional force concavo-convex 44ps and 10s of imprint sides shown in drawing 3 (B), and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the field in which concavo-convex 44ps is formed will be further deleted by relative sliding of about dozens of micrometers to minute irregularity of contact sheet 44 and 10s of imprint sides of bump 44B' 10a, and 44ms of irregularity of granularity with the finer surface roughness as shown in drawing 3 (C) will be formed.

[0046]

Then, as contact sheet 44'' which has bump 44B'' by which recovery was carried out is shown in drawing 1 (B), it is taken out from the carrier unit 40.

[0047]

Therefore, 44ms of comparatively detailed irregularity corresponding to the press and sliding of minute concavo-convex 10a of 10s of imprint sides in the imprint plate 10 will be formed in the latest field 44es of bump 44B'', without applying comparatively big thrust so that it may be expanded to drawing 2 (B) and drawing 3 (D) and may be shown.

[0048]

Moreover, as mentioned above, by heating, since it becomes easy to transform bump 44B, formation of above-mentioned irregularity becomes easier.

[0049]

Drawing 4 (A), (B), and (C) show the condition of each process of bump 44B' in the example of a comparison verified by the artificer of the invention in this application, respectively.

[0050]

In the example of a comparison, it considers only as what the contact sheet 44 with which bump 44B' as expanded to drawing 4 (A) like an above-mentioned example and shown in the above-mentioned carrier unit 40 was worn out is arranged, and is equipped with the imprint plate 10 same instead of being a bare chip 60 as mentioned above, without being heated like an above-mentioned example in performing recovery of an electrode.

[0051]

In this example of a comparison, bump 44B' is pressurized with the imprint plate 10 by the same predetermined pressure as an above-mentioned example along the direction which the arrow head F shown in drawing 1 (A) shows according to the energization force of a spring 54 through the press object 56. Drawing 4 (B) expands the condition of the point of bump 44BC immediately after 10s of imprint sides having contacted flatness side 44fs, and pressurizing them, and is shown. By this, the point of bump 44BC will be pressed by concavo-convex 10a of the imprint plate 10, and comparatively coarse concavo-convex 44ps will be formed so that clearly from drawing 4 (B).

[0052]

Next, the contact sheet which has bump 44BC by which recovery was carried out is taken out from the carrier unit 40.

[0053]

Therefore, comparatively coarse concavo-convex 44ps corresponding to the press of minute concavo-convex 10a of 10s of imprint sides in the imprint plate 10 will be formed in the latest field of bump 44BC so that it may be expanded to drawing 4 (C) and may be shown.

[0054]

Consequently, in the approach of the example of a comparison, it was checked that 44ms of comparatively detailed irregularity which is obtained in the example 1 of this application is not formed.

[0055]

In addition, in the invention in this application, effectiveness which applied the file to the connection side of bump 44B will be acquired by relative sliding between 10s of imprint sides and bump 44B which were mentioned above, moreover, as compared with the case where it imprints only by press, spacing of the irregularity will be more narrow, and irregularity will be formed certainly.

[0056]

Drawing 10 (A), (B), and (C) show typically each process in the 2nd example of the recovery



approach of the electrode concerning this invention.

[0057]

Drawing 10 (A) The contact sheet 80 used for the example shown in - (C) has two or more bump 84B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 84M, as shown in drawing 10 (A). The tip of each of that bump 84B has projected only predetermined height from the front face of base material 84M. Minute concavo-convex 84a is formed in the whole front face at the tip so that it may be expanded to drawing 11 (A) and may be shown.

[0058]

Each bump 84B is electrically connected to the pad (un-illustrating) through conductor-layer 84C made from copper foil. The pad is formed in the both ends which project towards the exterior from the both ends of the above base members 42 in base material 84M, respectively. Each bump 84B is formed in the gold (Knoop hardness: 80-200) or copper (Knoop hardness: 250-320) used as a base material in the shape of an approximate circle drill with the ingredient with which the predetermined crystal object 86 was mixed by abbreviation homogeneity.

[0059]

When a base material is gold, the crystal object 86 has the degree of hardness which consists of a golden degree of hardness size, is made from PARAJUUMU (Pd) with a particle diameter [ with comparatively high electrical conductivity ] of about 2-3 micrometers, and (Knoop hardness:250-350), and is mixed with the content of about 15 - 20% / vol extent.

[0060]

Moreover, when a base material is copper, the crystal object 86 has the degree of hardness which consists of a copper degree of hardness size, is made from nickel (nickel) with a particle diameter [ with comparatively high electrical conductivity ] of about 2-3 micrometers, and (Knoop hardness:300-490), and is mixed with the content of about 15 - 20% / vol extent.

[0061]

Base material 84M are made for example, from a polyimide resin ingredient (coefficient of linear expansion:  $35 \times 10^{-6}$ /degree C) in the shape of sheet metal, and have the thickness of about 40 micrometers.

[0062]

In carrying out recovery of the bump 84B as an electrode of this contact sheet 80, it is the basis arranged as mentioned above in the carrier unit 40 with the above-mentioned contact sheet 80 of one sheet, and recovery of the connection side at the tip of bump 84B will be automatically carried out by carrying out repeat use to a bare chip 60. Therefore, the press process and heating process of the imprint plate 10 used in the 1st above-mentioned example are made unnecessary.

[0063]

That is, the latest section of bump 84B will have predetermined crushing cost, and will be contacted by the electrode surface of a bare chip 60 by the predetermined pressure so that it may be expanded to drawing 10 (B) and drawing 11 (B) and may be shown, when a trial is presented with the contact sheet 80 in the carrier unit 40.

[0064]

then, by carrying out repeat use of the contact sheet 80 of one sheet to the bare chip 60 of a predetermined number, the latest section of each bump 84B' crushes so that it may be expanded to drawing 10 (C) and drawing 11 (C) and may be shown — having — abbreviation — it becomes the approximate circle frustum configuration of having a flat field. As shown in drawing 11 (C), minute irregularity will be formed in apical surface 84fs of such each bump 84B' when some of two or more crystal objects 86 contained by wear of a base material are exposed.

[0065]

Therefore, a field with new minute irregularity will be automatically formed in the latest section of each bump 84B' with wear of the base material of the latest section of each bump 84B'.

[0066]

In the carrier unit 40 used for the 1st example of the recovery approach of the electrode concerning above-mentioned this invention, only the predetermined range is supported relatively

[ front face / of the base member 42 ] movable to abbreviation parallel by the part in which two or more bump 44B which can be set on the contact sheet 44 is formed.

[0067]

However, the carrier unit which the structure of the carrier unit 40 does not necessarily need to be made in this way, for example, is shown in drawing 12 (A), (B) – drawing 14 (A), and (B) may be used.

[0068]

In drawing 12 (A) a carrier unit The carrier housing 47 which has hold section 47A in which a bare chip 60 or the imprint plate 10 is held like an above-mentioned example, The base member 43 which forms the pars basilaris ossis occipitalis of hold section 47A of the carrier housing 47, The contact sheet 45 arranged through the elastic sheet 41 on the base member 43, It is constituted including the lid 52 for press which comes to contain the press object which presses the electrode group or the imprint plate 10 of a bare chip 60 to bump 45B of the contact sheet 45, and the ratchet mechanism 49 which holds the lid 52 for press alternatively in the carrier housing 47. In addition, since the structures of the lid 52 for press and a ratchet mechanism 49 are a lid for press in the 1st above-mentioned example, and the structure and identitas of a ratchet mechanism, they omit the duplication explanation.

[0069]

The carrier housing 47 is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion:  $56 \times 10^{-6} / \text{degree C}$ ) is desirable, for example. As shown in drawing 12 (B), when being equipped with the lid 52 for press, the inner circumference section of hold section 47A of the carrier housing 47 is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. Hole 47a by which the conclusion member 51 later mentioned around central opening 47b is inserted in the bottom surface part of hold section 47A of the carrier housing 47 is formed in four places.

[0070]

The contact sheet 45 has two or more bump 45B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 45M. For example, only height predetermined [ front face / of the copper used as a base material / the front face of base material 45M to ] in nickel and the tip of each bump 45B which gold plate processing is carried out and is formed is projected. Base material 45M are made for example, from a polyimide resin ingredient (coefficient of linear expansion:  $35 \times 10^{-6} / \text{degree C}$ ) in the shape of sheet metal, and have the thickness of about 40 micrometers.

[0071]

Each bump 44B is connected to pad 45p through the conductor layer made from copper foil. Two or more pad 45p is formed in the both ends which project towards the exterior from the both ends of the base member 43 in base material 45M, respectively.

[0072]

The contact sheet 45 has hole 45a in which the conclusion member 51 is inserted corresponding to hole 47a of the carrier housing 47 around two or more bump 44B.

[0073]

The base member 43 is fabricated with the same ingredient as the ingredient of the carrier housing 47, and has hole 43a corresponding to hole 47a of the carrier housing 47, and hole 45a of the contact sheet 45.

[0074]

One of the roles which the elastic sheet 41 arranged just under two or more bump 44B of the contact sheet 45 plays is making into homogeneity dispersion in the contact force of bump 45B which originates in the protrusion height of each bump 45B like an above-mentioned example.

[0075]

As shown in drawing 12 (B), as a conclusion member 51 which concludes the carrier housing 47 and the base member 43 of each other on both sides of the contact sheet 45, a rivet or a screw, and a nut are desirable, for example.

[0076]

When such a carrier unit is used, while the contact sheet 45 with which the bump was worn out is first arranged like the 1st above-mentioned example in a bump's recovery, the above-mentioned carrier unit equipped with the imprint plate 10 instead of the bare chip 60 is arranged in the thermostat 12 which maintains whenever [ predetermined room air temperature ].

[0077]

The conditions of thrust are set up like the 1st above-mentioned example.

[0078]

Next, the temperature in a thermostat 12 is made to go up by the range from reference condition to [ from 80 degrees C or more ] 150 degrees C, and is maintained 5 minutes or more. In addition, the temperature and the period to maintain in a thermostat 12 are preferably set up in about 15 minutes at the room temperature of 150 degrees C.

[0079]

Therefore, the imprint plate 10, and the base member 43, the carrier housing 47 and the contact sheet 45 [ when it expands along with the temperature rise of a room temperature, respectively ] Since the coefficient of linear expansion of carrier housing 47 grade is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0080]

Drawing 13 (A) and (B) show other carrier units used for an example of the recovery approach of the electrode concerning this invention, respectively.

[0081]

In the carrier unit shown in drawing 12 (A) and (B), although the carrier housing 47 and the base member 43 of each other are concluded by the conclusion member 51 on both sides of the contact sheet 45 instead, in drawing 13 (A) and (B), the carrier housing 47 and the base member 43 of each other are joined on both sides of the contact sheet 45 by adhesives or fusion welding. In addition, in drawing 13 (A) and (B), the same sign is attached and shown about the component made the same in drawing 12 (A) and (B), and the duplication explanation is omitted.

[0082]

Carrier housing 47' is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion:  $56 \times 10^{-6} / \text{degree C}$ ) is desirable, for example. As shown in drawing 13 (B), when being equipped with the lid 52 for press, the inner circumference section of hold section 47'A of carrier housing 47' is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. In the bottom surface part which forms the base of hold section 47'A of carrier housing 47', opening 47'b is formed in the center.

[0083]

Base member 43' is fabricated with the same ingredient as the ingredient of carrier housing 47', and has gage pin 43'P in four places respectively corresponding to hole 45a of the contact sheet 45. Gage pin 43'P has projected predetermined die length, for example, thickness extent of the contact sheet 45, to the field where the elastic sheet 41 is arranged. Let locator-pin 43'P be a thing for carrying out the variation rate of the contact sheet 45 similarly according to the thermal expansion of base member 43', or the variation rate of contraction while it positions the relative position to base member 43' of the contact sheet 45. the base — a member — 43 — ' —  
— a carrier — housing — 47 — ' — hold — the section — 47 — ' — A — receiving — a relative position — fusion welding — the time — positioning — having .

[0084]

Also in this example the imprint plate 10, and base member 43', and carrier housing 47' and the contact sheet 45 [ when it expands along with the temperature rise of a room temperature, respectively ] Since coefficient of linear expansion, such as carrier housing 47', is set as size



rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0085]

drawing 14 (A) and (B) are used for an example of the recovery approach of the electrode concerning this invention, respectively — being the further — others — a carrier unit is shown.

[0086]

the carrier unit shown in drawing 13 (A) and (B) — setting — the contact sheet 45 — inserting — carrier housing 47' and a locator pin 43, although the 'base member 43 which has P' of each other is joined instead — drawing 14 — (— A —) — and — (— B —) — setting — adhesives — or — fusion welding — contact — a sheet — 45 — inserting — a locator pin — 47 — " — P — having — a carrier — housing — 47 — " — the base — a member — 43 — " — mutual — joining — having — a thing — \*\* — carrying out — having . In addition, in drawing 14 (A) and (B), the same sign is attached and shown about the component made the same in drawing 12 (A) and (B), and the duplication explanation is omitted.

[0087]

Carrier housing 47" is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion:  $56 \times 10^{-6} / \text{degree C}$ ) is desirable, for example. As shown in drawing 14 (B), when being equipped with the lid 52 for press, the inner circumference section of carrier housing 47 "hold section 47" A is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. In the bottom surface part of carrier housing 47 "hold section 47" A, opening 47"b is formed in the center. In the surrounding external surface of opening 47"b, gage pin 47"P has projected at four places respectively corresponding to hole 45a of the contact sheet 45. Gage pin 47"P has projected predetermined die length, for example, thickness extent of the contact sheet 45, to the base. Let locator-pin 47"P be a thing for carrying out the variation rate of the contact sheet 45 similarly according to the thermal expansion of carrier housing 47", or the variation rate of contraction while it positions the relative position to carrier housing 47" of the contact sheet 45. The relative position to base member 43" of hold section 47'A of carrier housing 47" is positioned at the time of fusion welding.

[0088]

Base member 43" is fabricated with the same ingredient as the ingredient of carrier housing 47."

[0089]

Also in this example the imprint plate 10, and base member 43", and carrier housing 47" and the contact sheet 45 [ when it expands along with the temperature rise of a room temperature, respectively ] Since coefficient of linear expansion, such as carrier housing 47", is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0090]

Drawing 15 and drawing 16 show roughly the configuration of the carrier unit stage used for the 3rd example of the recovery approach of the electrode concerning this invention, respectively with the imprint plate fixed head.

[0091]

In addition, in drawing 15 and drawing 16 , the same sign is attached and shown about the component made the same in the carrier unit in the example shown in drawing 7 and drawing 8 , and the duplication explanation is omitted. Moreover, in drawing 15 and drawing 16 , the condition



that some components of the carrier unit in the condition that the lid for press was removed were held in the carrier unit stage is shown.

[0092]

As the part is shown in drawing 15 and drawing 17 , a carrier unit The carrier housing 116 which has hold section 116A in which a bare chip 60 is held, The contact sheet 44 arranged through the elastic sheet 110 on the base member 108 which forms the pars basilaris ossis occipitalis of hold section 116A of the carrier housing 116, It is constituted including ratchet-mechanism 116F which hold alternatively the lid for press which comes to contain the press object which presses the electrode group of a bare chip 60 to bump 44B of the contact sheet 44, and (un-illustrating) and its lid for press in the carrier housing 116.

[0093]

In addition, the above-mentioned lid for press which is not illustrated is equipped with the configuration in the example shown in drawing 8 , and the same configuration.

[0094]

Ratchet-mechanism 116F are constituted by the both ends of the carrier housing 116 as shown in drawing 7 including the hook member which is supported rotatable with a support shaft and holds the edge of the lid for press, and the coil spring which energizes a hook member in the direction made to engage with the edge of the lid for press, respectively, respectively.

[0095]

The carrier unit stage 106 has hold section 106A which holds the carrier housing 116 temporarily in the recovery of bump 44B of the contact sheet 44. As shown in drawing 15 and drawing 17 , in order to regulate the relative position to hold section 106A of the base member 108, the inner circumference section of hold section 106A which carries out opening towards the upper part is formed so that it may engage with the edge of the base member 108.

[0096]

As shown in drawing 16 and drawing 17 , the ratchet mechanism of the pair held removable in hold section 106A carries out phase opposite of the carrier housing 116 of a carrier unit, and it is prepared in the periphery section of hold section 106A. The ratchet mechanism is constituted by the wall which forms hold section 106A in the carrier unit stage 106 including the hook member 112 which is supported rotatable with the support shaft 118 and holds the periphery section of hold section 116A of the carrier housing 116, and the coil spring 114 which energizes the hook member 112 in the direction made to engage with the periphery section of hold section 116A, respectively, respectively.

[0097]

As shown to drawing 17 by the two-dot chain line, the end resists the energization force of a coil spring 114, and when equipped only with the carrier housing 116 of a carrier unit in hold section 106A, or when being removed from hold section 106A, the hook member 112 is rotated so that it may be isolated out of hold section 106A. On the other hand, when the carrier housing 116 is held in hold section 106A, the end of the hook member 112 is contacted by the periphery section of hold section 116A of the carrier housing 116 according to the energization force of a coil spring 114, as shown in drawing 15 and drawing 17 .

[0098]

When recovery is performed about the contact sheet 44 with which the bump was worn out so that it may mention later, the imprint plate fixed head is arranged in hold section 116A of the carrier housing 116 in a carrier unit, as shown in drawing 15 .

[0099]

The press object 102 which has fixed side 102a to which the imprint plate 104 is fixed as the imprint plate fixed head is shown in drawing 15 , The body 100 of a lid which has the crevice in which the base of the press object 102 is held, It is allotted to each space between the crevice of the base of the press object 102, and the comparatively deep crevice of the body 100 of a lid, respectively, and is constituted including two or more springs 103 which turn the imprint plate 104 to bump 44B of the contact sheet 44, and energize it.

[0100]

The base of the press object 102 is inserted movable into the comparatively shallow large

crevice of the body 100 of a lid. 102n of claw parts which engage with the claw part prepared in the lower limit of the body 100 of a lid carries out phase opposite, and they are formed in the edge of a part at which the press object 102 is inserted. [ two or more ] By this, the press object 102 will be held at the body 100 of a lid in the condition of having been energized by the energization force of two or more springs 103.

[0101]

One field of the imprint plate 104 made from a metallic material or a ceramic ingredient is being fixed by adhesion or the conclusion implement to fixed side 102a. Irregularity with predetermined flatness and predetermined surface roughness is formed in the field of another side of the imprint plate 104. In addition, the imprint plate 104 may be formed in the press object 102 and one, without being restricted to this example. Moreover, the press object 102 may be formed in the body 100 of a lid, and one, for example, without two or more springs 103 intervening.

[0102]

On the other hand, the lid for press of a carrier unit (un-illustrating) is held by the ratchet-mechanism 116F at the carrier housing 116, when a trial is performed to a bare chip 60.

[0103]

100s of female screw sections in which the male screw section of the load cell mentioned later is inserted is prepared in the abbreviation center section of the upper part of the body 100 of a lid.

[0104]

Drawing 18 shows roughly the whole sliding equipment configuration to which the contact sheet 44 is relatively moved to the imprint plate fixed head in the process of the recovery about bump 44B of the contact sheet 44.

[0105]

sliding equipment be constitute including the table device section which make it move in the predetermined direction , and the pressurization device section which the imprint plate fixed head be hold [ section ] and make a predetermined pressure act on bump 44B of the imprint plate 104 and the contact sheet 44 while fix the carrier unit stage 106 holding the carrier housing 116 with which it be allot on the base member 120 , and the contact sheet 44 be hold .

[0106]

The pedestal 122 matched with the table device section on the base member 120, and X shaft-orientations stage member 126 moved by the ball screw member 124 supported by the pedestal 122, Y shaft-orientations stage member 130 moved in the direction of an axis of the ball screw member 124 by the ball screw member 132 supported by X shaft-orientations stage member 126 along the direction which carries out an abbreviation rectangular cross, It is constituted including the rotation stage 136 which is supported rotatable by the stage supporter 134 allotted to Y shaft-orientations stage member 130, and holds a carrier unit.

[0107]

A pedestal 122 consists of a handstand surface part which carries out breadth extension in the direction which an arrow head Z shows to an abbreviation perpendicular to the flat part formed along the direction which the arrow head X in drawing 18 shows, and a flat part.

[0108]

X shaft-orientations stage member 126 is guided with a guide rail 168, and is supported by the ball screw member 124 movable through the nut. The both ends of the ball screw member 124 are supported by the edge which met in the direction which an arrow head X shows in drawing 18 in the flat part of a pedestal 122, respectively. The output shaft of the drive motor 160 fixed to a pedestal 122 through moderation device 160GH, such as an epicyclic gear device, is connected with one edge of the ball screw member 124. In addition, as for a drive motor 160, a linear motor, a stepping motor, a servo motor, etc. may be used. A drive motor 160 and each drive motor mentioned later are controlled by the control unit 150 mentioned later.

[0109]

Y shaft-orientations stage member 130 is supported by the inner circumference section of X shaft-orientations stage member 126 movable along the perpendicular direction at space with the guide rails 128A and 128B by which pair opposite arrangement is carried out. Moreover, Y

shaft-orientations stage member 130 is supported by the ball screw member 132 movable through the nut. The both ends of the ball screw member 132 are supported by the edge which met perpendicularly in drawing 18 in X shaft-orientations stage member 126 at space, respectively. The output shaft of the drive motor 162 fixed to X shaft-orientations stage member 126 through moderation devices, such as an epicyclic gear device, is connected with one edge of the ball screw member 132. As for a drive motor 162, a linear motor, a stepping motor, a servo motor, etc. may be used.

[0110]

The drive motor 164 is being fixed to the center section of the stage supporter 134 fixed to the top face of Y shaft-orientations stage member 130. The stage supporter 134 is being fixed to the top face of Y shaft-orientations stage member 130 through the notch of X shaft-orientations stage member 126. It connects with the output shaft of a drive motor 164 inside the center of the disk section of the rotation stage 136 through moderation device 164GH. The side attachment wall of the rotation stage 136 is supported by the upper part of the stage supporter 134 rotatable through bearing 137. As for a drive motor 164, a linear motor, a stepping motor, a servo motor, etc. may be used.

[0111]

This will rotate the rotation stage 136 to the circumference of the medial-axis line of Y shaft-orientations stage member 130, and the medial-axis line of the stage supporter 134, when a drive motor 164 is made into an operating state.

[0112]

The carrier unit stage 106 is being fixed by the conclusion member to which illustration is abbreviated, for example, a \*\*\*\* member etc., to the disk section of the rotation stage 136.

[0113]

The pressurization device section is constituted including Z shaft-orientations stage member 140 which transmits thrust to the imprint plate fixed head, the ball screw member 142 which it is inserted in Z shaft-orientations stage member 140, and is supported movable, and the drive motor 166 made to rotate the ball screw member 142 while holding the load cell 138 which detects the thrust to bump 44B through the imprint plate fixed head, and a load cell 138.

[0114]

The both ends of the ball screw member 142 are supported by the bracket section of the pair prepared in a handstand surface part by having predetermined spacing rotatable, respectively. One edge of the ball screw member 142 is connected with the output shaft of the drive motor 166 fixed to a handstand surface part through moderation device 166GH. As for a drive motor 166, a linear motor, a stepping motor, a servo motor, etc. may be used.

[0115]

Z shaft-orientations stage member 140 is guided with the guide rail 144 so that it may be inserted in so that the ball screw member 142 may serve as an abbreviation perpendicular to the axis through a nut, and it may not rotate.

[0116]

The load cell 138 is connected with the body 100 of a lid by thrusting into 100s of female screw sections of the imprint plate fixed head 138s of male screw sections connected with the internal sensor section. A load cell 138 sends out the detecting signal Sp which detects the thrust to the imprint plate fixed head of Z shaft-orientations stage member 140, and expresses thrust to a control unit 150.

[0117]

The migration direction command signal Sd showing the direction where the reset command signal Sr and the carrier housing 116 showing the instruction which returns the location of each stage member from the host computer for production control with which illustration is omitted to a predetermined criteria location should move to a control unit 150, the recovery initiation command signal Ss, and the detecting signal Sp from the above-mentioned load cell 138 are supplied.

[0118]

Moreover, the control unit 150 equips the interior with the memory section 150 in which the



program data for performing the data showing the set point of the thrust to the imprint plate fixed head set up according to the contact sheet 44 or the set point of the movement magnitude of the carrier housing 116 (carrier unit stage 106) and recovery etc. are stored.

[0119]

The value of the thrust is set up according to the magnitude of bump 44B, for example, let it be the range of 1g or more per electrode 100g or less. As an example of the range of the minimum in the value of thrust, it considers as the range of 1g or more per electrode 40g or less.

[0120]

The movement magnitude of the one direction of the carrier housing 116 (carrier unit stage 106) is set up so that bending of the play of each device and the contact sheet 44 etc. may be considered, and it may be set up, for example, the relative movement magnitude of bump 44B may serve as the 1-micrometer or more range of 1mm or less. As an example of the range of the minimum in the relative movement magnitude of bump 44B, it considers as the 1-micrometer or more range of 100 micrometers or less.

[0121]

In the recovery by the 3rd example in the recovery approach of the electrode concerning this invention, first, as shown in drawing 18, the carrier unit stage 106 in which the carrier housing 116 with which the contact sheet 44 with which the bump was worn out is arranged was attached is held at the disk section of the rotation stage 136 in a predetermined criteria location.

[0122]

Next, a control unit 150 sets up the movement magnitude of each stage member so that the movement magnitude of the carrier housing 116 and the carrier unit stage 106 may serve as a predetermined value based on the data in the recovery initiation command signal Ss, the migration direction command signal Sd, and the memory section 150.

[0123]

A control unit 150 sets up the movement magnitude of the Z-axis stage 140 based on the data of the set point of the thrust in a detecting signal Sp and 150m of memory sections in that case.

[0124]

A control unit 150 forms the pulse control signal Cz according to the set-up movement magnitude, and supplies it to the motorised circuit 158. Based on the pulse control signal Cz, a driving signal shall be supplied to the motorised circuit 158.

[0125]

Then, a control unit 150 forms the pulse control signals Cx, Cy, and Cr so that it may move the carrier housing 116 and the carrier unit stage 106 only once [ at least ] according to the set-up movement magnitude, and it supplies them to the motorised circuits 152, 154, and 156, respectively. Based on the pulse control signals Cx, Cy, and Cr, a driving signal shall be supplied to the motorised circuits 152, 154, and 156 to drive motors 160, 162, and 164, respectively.

[0126]

Thereby, only the specified quantity is made to move relatively bump 44B of the contact sheet 44 in the carrier housing 116 in the predetermined direction once to the imprint plate 104.

[0127]

Therefore, the comparatively detailed irregularity corresponding to the press and sliding of an imprint side of minute irregularity in the imprint plate 104 will be formed in the edge at which the bump was worn out, without applying comparatively big thrust like the case of the 1st above-mentioned example. The irregularity is spacing of for example, about 0.1-micrometer or more 50-micrometer or less extent, and is formed in about 0.001-micrometer or more height of 5 micrometers or less. As range of the minimum of the irregularity, it is spacing of about 0.1-micrometer or more 50-micrometer or less extent, and considers as the range of about 0.002-micrometer or more height 3 micrometers or less, for example.

[0128]

Moreover, in this example, since it is not necessary to heat like [ in the case of the 1st example ], control of the amount of sliding in recovery is easy, and it can process comparatively



for a short period of time, consequently is more suitable for mass-production nature.

[0129]

And that thrust should be canceled, a control unit 150 forms the pulse control signal Cz, and supplies it to the motorised circuit 158.

[0130]

The carrier housing 116 with which the contact sheet by which recovery was carried out is held is removed from the carrier unit stage 106. In that case, a control unit 150 forms the control pulse signals Cx, Cy, Cr, and Cz, and supplies them to the motorised circuits 152, 154, 156, and 158 so that it may return the location of each stage member to a predetermined criteria location based on the control signal Sr supplied.

[0131]

After being equipped with a bare chip 60 and the lid for press, the hold section of IC socket 30 will be equipped with the removed carrier housing 116 as a carrier unit like an above-mentioned example.

[0132]

[Effect of the Invention]

According to the recovery approach of the electrode concerning this invention, so that clearly from the above explanation Turning to the connection side of the polar zone the imprint plate laid in the connection side of the polar zone in the 1st process, and pressing it by the predetermined pressure Easy and, certainly predetermined irregularity can be formed in the connection side of the polar zone of the electrode plate worn out since the imprint plate and the electrode plate were deleted from the connection side of an electrode by predetermined granularity at predetermined temperature a predetermined period and by sliding relatively according to the expansion difference since it heats.

[Brief Description of the Drawings]

[Drawing 1] (A) and (B) are drawings showing typically each process of the 1st example of the recovery approach of the electrode concerning this invention, respectively.

[Drawing 2] (A) is a fragmentary sectional view with which is a fragmentary sectional view with which explanation of each process is presented, and a bump's point in the process shown in drawing 1 (B) expands (B) partially, is shown [ a bump's point in the process shown in drawing 1 (A) is expanded partially, and is shown, and ], and explanation of each process is presented.

[Drawing 3] (A), (B), (C), and (D) are fragmentary sectional views with which a bump's point in each process of the 1st example of the recovery approach of the electrode concerning this invention is expanded partially, and is shown, respectively, and explanation of each process is presented.

[Drawing 4] (A), (B), and (C) are fragmentary sectional views with which a bump's point in each process of the example of a comparison is expanded partially, and is shown, and explanation of each process of the example of a comparison is presented, respectively.

[Drawing 5] (A), (B), and (C) are drawings with which explanation of each process at which a bump's tip is worn out by use is presented, respectively.

[Drawing 6] A bump's tip which a bump's tip is expanded partially, respectively, and (A), (B), and (C) are shown, and is shown in drawing 5 (A), (B), and (C) is drawing with which explanation of each process worn out by use is presented.

[Drawing 7] It is the fragmentary sectional view showing an example of the socket for semiconductor devices equipped with the contact sheet with which the 1st example and the 2nd example of the recovery approach of the electrode concerning this invention are applied.

[Drawing 8] It is the fragmentary sectional view showing roughly the configuration of the carrier unit in the example shown in drawing 7 .

[Drawing 9] It is a top view in the example shown in drawing 8 .

[Drawing 10] (A), (B), and (C) are the fragmentary sectional views expanding and showing the important section with which explanation of each process of the 2nd example of the recovery approach of the electrode concerning this invention is presented, respectively.

[Drawing 11] (A), (B), and (C) are the fragmentary sectional views expanding and showing some drawings shown in drawing 10 (A), (B), and (C), respectively.

[Drawing 12] (A) is the block diagram decomposing and showing the configuration of an example of other carrier housing used for the 1st example of the recovery approach of the electrode concerning this invention, and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).

[Drawing 13] (A) is used for the 1st example of the recovery approach of the electrode concerning this invention -- being the further -- others -- it is the block diagram decomposing and showing the configuration of an example of carrier housing and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).

[Drawing 14] (A) is used for the 1st example of the recovery approach of the electrode concerning this invention -- being the further -- others -- it is the block diagram decomposing and showing the configuration of an example of carrier housing and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).

[Drawing 15] It is the sectional view showing the configuration of the carrier unit stage used for the 3rd example of the recovery approach of the electrode concerning this invention with the imprint plate fixed head.

[Drawing 16] It is a top view in the example shown in drawing 15 .

[Drawing 17] It is the block diagram decomposing and showing the configuration of carrier housing shown in drawing 15 , and a carrier unit stage.

[Drawing 18] It is the block diagram showing the whole sliding equipment configuration used for the 3rd example of the recovery approach of the electrode concerning this invention.

[Description of Notations]

10a Irregularity

10,104 Imprint plate

10s Imprint side

12 Thermostat

44 80 Contact sheet

44B, 44B', 44B'', and 84B and 84B -- ' -- Bump

44a, 44ps, 44ms, 84a Irregularity

44M, 84M Base material

60 Bare Chip

86 Crystal Object

126 X Shaft-Orientations Stage Member

130 Y Shaft-Orientations Stage Member

136 Rotation Stage

140 Z Shaft-Orientations Stage Member

160,162,164 166 Motor for a drive

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[Translation done.]

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TECHNICAL FIELD

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[Field of the Invention]

This invention relates to the recovery approach of an electrode that the connection side of the polar zone of an electrode plate which has the polar zone which performs electrical installation to the terminal of a semiconductor device can be recovered so that it may become predetermined surface roughness.

[0002]

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PRIOR ART

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[Description of the Prior Art]

In the IC socket for electronic equipment, or a connector, it is requested that the terminal of the semiconductor device with which the electrode of the substrate for wiring is equipped is generally connected certainly electrically. In such equipment, as shown also in JP,8-96865,A and JP,2000-294043,A, forming by etching processing is proposed [ projection / thermal spraying or / minute ] in ceramic-flame-spraying coats enough in order to break through the oxide skin formed in the terminal at the electric contact section of the conductor pattern to which the terminal (electrode) of a semiconductor device is connected electrically, or the end face of a track, for example. Thus, by forming a minute projection in the electric contact section or the end face of a track, since a mutual touch area is reduced and the contact pressure per unit area increases, the effectiveness that an oxide skin is easy to be destroyed will be done so.

[0003]

Consequently, the terminal of a semiconductor device will be electrically connected to the electrode of the substrate for wiring certainly.

[0004]

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EFFECT OF THE INVENTION

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[Effect of the Invention]

According to the recovery approach of the electrode concerning this invention, so that clearly from the above explanation Turning to the connection side of the polar zone the imprint plate laid in the connection side of the polar zone in the 1st process, and pressing it by the predetermined pressure Easy and, certainly predetermined irregularity can be formed in the connection side of the polar zone of the electrode plate worn out since the imprint plate and the electrode plate were deleted from the connection side of an electrode by predetermined granularity at predetermined temperature a predetermined period and by sliding relatively according to the expansion difference since it heats.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention]

In the above IC sockets for electronic equipment, when the electric contact section of a conductor pattern is used repeatedly, since there is a fixed life also in the endurance of the minute projection which has the above abrasion resistance, and a ceramic-flame-spraying coat, a minute projection will be worn out with contact pressure etc. therefore, abbreviation which does not have irregularity, without recovering the electric contact section or the end face of a track according to operating frequency -- since it becomes a flat front face, there is a possibility that a touch area may increase and contact pressure may become inadequate. Consequently, the positive electric connection obtained at the beginning may not no longer be obtained as it uses it.

[0005]

It is the recovery approach of an electrode that the connection side of the polar zone of an electrode plate which has the polar zone to which this invention performs electrical installation to the terminal of a semiconductor device in consideration of the above trouble can be recovered so that it may become predetermined surface roughness, and aims at offering the recovery approach of the electrode which can form easy and, certainly predetermined irregularity to the connection side of the polar zone of the worn-out electrode plate.

[0006]

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MEANS

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[Means for Solving the Problem]

In order to attain the above-mentioned purpose, the recovery approach of the electrode concerning this invention To the connection side of the polar zone in the electrode plate which has the polar zone formed on an insulating substrate, and performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device The 1st process which lays the front face and connection side of an imprint plate which have the front face in which it is made from the ingredient of the coefficient of linear expansion of the insulating substrate of an electrode plate, and a different coefficient of linear expansion, and irregularity is formed so that it may contact mutually, Turning to the connection side of the polar zone the imprint plate laid in the connection side of said polar zone in the 1st process, and pressing it by the predetermined pressure A predetermined period, the 2nd process to heat, and an imprint plate are made to isolate an imprint plate and this electrode plate to said electrode plate at predetermined temperature, and it comes to contain the 3rd process which obtains predetermined irregularity to the connection side of the polar zone.

[0007]

Moreover, the 2nd predetermined temperature and predetermined period in a process are a temperature requirement from 80 degrees C or more to less than 150 degrees C, and may be set as the period for 15 or less minutes 5 minutes or more, respectively.

[0008]

Furthermore, the recovery approach of the electrode concerning this invention The polar zone which comes by specified quantity \*\*\*\* into a base material is formed on an insulating substrate in the minute crystal object which has the abrasion resistance which was excellent as compared with the abrasion resistance of a base material. The 1st process which lays the terminal area of a semiconductor device in the connection side of the polar zone in the electrode plate which performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device, It comes to contain the 2nd process which obtains predetermined irregularity to a connection side by wearing a connection side, contacting the terminal area of a semiconductor device to the connection side of an electrode plate, and exposing some crystal objects.

[0009]

A crystal object has the degree of hardness which consists of a degree of hardness of the copper which is a base material size, and may be made from PARAJUUMU or nickel with comparatively high electrical conductivity.

[0010]

The recovery approach of the electrode concerning this invention further again To the connection side of this polar zone in the electrode plate which has the polar zone formed on an insulating substrate, and performs electrical installation through the connection side of the polar zone to the terminal area of a semiconductor device The 1st process which lays the front face and connection side of an imprint plate which have the front face in which irregularity is formed so that it may contact mutually, Turning to the connection side of the polar zone the imprint plate laid in the connection side of the polar zone in the 1st process, and pressing it by the

predetermined pressure To a connection side, it shifts and comes to include an imprint plate or the connection side of the polar zone the 3rd process without abbreviation parallel which obtains irregularity predetermined to the connection side of the polar zone once [ at least ] in that direction by making the specified quantity, the 2nd process to which it is made to move relatively, and an imprint plate isolate to an electrode plate.

[0011]

Moreover, an electrode plate is made to move to an imprint plate in the 2nd process with the sliding equipment moved to abbreviation parallel to the connection side of the polar zone, supporting an electrode plate.

[0012]

The thrust in the 2nd process may be 1g or more per polar zone 100g or less, and the specified quantity of the relative migration in the 2nd process may be 1 micrometers or more 1mm or less.

[0013]

[Embodiment of the Invention]

Drawing 7 shows the socket for semiconductor devices equipped with the electrode plate for connection with which the 1st example, 2nd example mentioned later, and 3rd example of the recovery approach of the electrode concerning this invention are applied.

[0014]

In the socket for semiconductor devices shown in drawing 7 , it considers as the electrical-characteristics trial of a semiconductor device, and the thing specifically used for a burn in test etc., for example. The socket for semiconductor devices is constituted including the carrier unit 40 by which the bare chip as a semiconductor device is held in the interior, and IC socket 30 with which the hold section is equipped with the carrier unit 40 removable.

[0015]

The body section 32 which has the hold section which IC socket 30 is arranged on the printed-circuit board 38 which outputs and inputs the inspection signal to a bare chip, the detection output signal from a bare chip, etc., and holds the carrier unit 40, The contact group 34 which consists of two or more contacts electrically connected to each pad of the contact sheet as an electrode plate for connection which is formed in the body section 32 and serves as a component in the carrier unit 40, and which is mentioned later, respectively, The covering member 36 which is allotted possible [ a vertical movement ] to the body section 32, and connects each contact surface of the contact group 34 to each pad of a contact sheet electrically alternatively is constituted as main elements.

[0016]

The body section 32 fabricated with a resin ingredient is arranged in the predetermined location corresponding to the polar zone of a printed-circuit board 38. The body section 32 has hold section 32A in which the carrier unit 40 is held, as shown in drawing 7 . Hold section 32A is surrounded by the inner circumference section of lower pedestal 32a which engages with the lower part of the base section of the carrier unit 40 mentioned later, and the inner circumference section of up pedestal 32b which stands in a row in lower pedestal 32a, and engages with the upper part of the base section, and is formed. The contact group 34 is supported by lower pedestal 32a. the contact group 34 is constituted in lower pedestal 32a and up pedestal 32b -- each -- the slit in which contact 34ai ( $i=1-n$  and  $n$  integer) is inserted is formed.

[0017]

each -- contact 34ai ( $i=1-n$  and  $n$  integer) 34f of fixed side contact surfaces which stand in a row in terminal area 34T currently pressed fit in lower pedestal 32a, and terminal area 34T, and are electrically connected to the pad of a contact sheet from a lower part side, 34m of movable side contact surfaces which have elasticity, stand in a row in terminal area 34T, and are electrically connected to the pad of a contact sheet from an upper part side, It engages with the slant surface part of the covering member 36 which branches from 34m of movable side contact surfaces, and is mentioned later alternatively, and is constituted including engaged portion 34e which rotates 34m of movable side contact surfaces in the direction isolated to 34f of fixed side



contact surfaces.

[0018]

each — contact 34ai is arranged at the predetermined spacing along the abbreviation perpendicular direction in drawing 7 to space corresponding to the pad of the contact sheet 44 mentioned later. In addition, in drawing 7, the contact group 34 of only the part corresponding to one side in the contact group 34 which encloses the four way type of hold section 32A is shown.

[0019]

The covering member 36 fabricated with a resin ingredient has opening 36a which the carrier unit 40 passes. A part for the frame which forms the periphery of opening 36a is supported possible [ a vertical movement ] by the leg guided in the slot established in the periphery section of the body section 32. In addition, the covering member 36 is energized in the direction isolated to the body section 32 by the elastic member to which illustration is abbreviated. the time of the covering member 36 being made to descend to the lower limit of each side for the frame to a predetermined location, as shown by the NI point chain line of drawing 7 — a \*\*\*\* — each — it engages with engaged portion 34e of contact 34ai, and 36s of slant surface parts which rotate 34m of movable side contact surfaces in the direction which resists the elastic force and is isolated to 34f of fixed side contact surfaces is formed, respectively.

[0020]

When hold section 32A of the body section 32 of IC socket 30 is equipped with the carrier unit 40 mentioned later, after the covering member 36 is made to retreat to hold section 32A the specified quantity and by carrying out depression maintenance in 34m of each traveling contact section of the contact group 34, the carrier unit 40 is positioned and laid in hold section 32A through opening 36a from the upper part. 34f of fixed side contact surfaces is made to contact the inferior-surface-of-tongue side of the pad of the contact sheet 44 in the carrier unit 40 in that case.

[0021]

then, the time of the covering member 36 in the condition of having been held being released — the return force of an above-mentioned elastic body — and — each — the covering member 36 is made to go up by resultant force of the elastic force of engaged portion 34e of contact 34ai 34m of each traveling contact section of the contact group 34 is returned to the original location, and it is made to contact the top-face side of the pad of the contact sheet 44 of the carrier unit 40 in that case. By that cause, as shown in drawing 7, the contact sheet 44 and the contact group 34 will be connected electrically.

[0022]

The carrier housing 46 which has hold section 46A in which a bare chip 60 is held as the carrier unit 40 is shown in drawing 8, The contact sheet 44 arranged through the elastic sheet 58 on the base member 42 which forms the pars basilaris ossis occipitalis of hold section 46A of the carrier housing 46, It is constituted including the lid 52 for press which comes to contain the press object 56 which presses the electrode group of a bare chip 60 to bump 44B of the contact sheet 44, and the ratchet mechanism 50 (refer to drawing 7) which holds the lid 52 for press alternatively in the carrier housing 46.

[0023]

As shown in drawing 8, the lid 52 for press is arranged on the space between the press object 56 which has press side 56a which contacts the top face of a bare chip 60, the body 64 of a lid which holds the base of the press object 56, and the crevice of the base of the press object 56 and the comparatively deep crevice of the body 64 of a lid, and is constituted including two or more springs 54 which turn the press object 56 to a bare chip 60, and energize it.

[0024]

The bare chip 60 of an abbreviation square has the predetermined electrode group on the inferior surface of tongue which counters the bump of the contact sheet 44.

[0025]

The base of the press object 56 is inserted movable into the comparatively shallow large crevice of the body 64 of a lid. 56n of claw parts which engage with the claw part prepared in the lower

limit of the body 64 of a lid carries out phase opposite, and they are formed in the edge of a part at which the press object 56 is inserted. [ two or more ] By this, the press object 56 will be held in the condition of having been energized by the energization force of a spring 54 at the body 64 of a lid.

[0026]

The body 64 of a lid has height 64p to which the hook members 48A and 48B of a ratchet mechanism 50 engage with the both ends which counter, respectively. At the time of wearing of the lid 52 for press, height 64p engages with the inclined plane at the tip of the hook members 48A and 48B, and has slant surface part 64ps which presses the hook members 48A and 48B in the direction isolated mutually so that it may mention later.

[0027]

The hook members 48A and 48B which a ratchet mechanism 50 is supported by the both ends of the carrier housing 46 rotatable, respectively, and hold the body 64 of a lid, The torsion coiled spring 66 energized in the direction where an arrow head shows the hook members 48A and 48B in drawing 7 , respectively, i.e., the direction made to engage with height 64p of the body 64 of a lid, It is constituted including the hook members 48A and 48B and the support shaft 68 which supports the torsion coiled spring 66.

[0028]

When equipped with the lid 52 for press, 46g of guide sections to which it shows the periphery section of the lower part of the body 64 of a lid is formed in the both ends of the carrier housing 46. The both ends of the support shaft 68 are supported around 46g of guide sections.

[0029]

The contact sheet 44 has two or more bump 44B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 44M, as shown in drawing 8 and drawing 9 . For example, only height predetermined [ front face / of the copper used as a base material / the front face of base material 44M to ] in nickel and the tip of each bump 44B which gold plate processing is carried out and is formed is projected. Base material 44M are made for example, from a polyimide resin ingredient (coefficient of linear expansion:  $35 \times 10^{-6} / \text{degree C}$ ) in the shape of sheet metal, and have the thickness of about 40 micrometers.

[0030]

Each bump 44B is connected to pad 44p through conductor-layer 44c made from copper foil, as shown in drawing 9 . Pad 44p is formed in the both ends which project towards the exterior from the both ends of the base member 42 in base material 44M, respectively.

[0031]

In addition, only the predetermined range is supported relatively [ front face / of the base member 42 ] movable to abbreviation parallel by the part in which two or more bump 44B which can be set on the contact sheet 44 is formed.

[0032]

In this configuration, in equipping with a bare chip 60 in the carrier unit 40, first, the electrode group of a bare chip 60 is positioned to bump 44B of the contact sheet 44, and it is arranged so that the electrode group of a bare chip 60 may contact bump 44B. Next, the lid 52 for press is inserted into hold section 46A of the carrier housing 46. It rotates in the direction which resists the energization force of the torsion coiled spring 66, and the tip of the hook members 48A and 48B of a ratchet mechanism 50 isolates mutually by slant surface part 64ps of the body 64 of a lid of the lid 52 for press in that case. Moreover, the peripheral face of the body 64 of a lid being guided at the inside which is 46g of guide sections, press side 56a of the press object 56 resists the energization force of a spring 54, and is forced on the top face of a bare chip 60.

[0033]

Then, by being energized from the torsion coiled spring 66, the tip of the hook members 48A and 48B rotates in the direction which approaches mutually, and engages with height 64p of the body 64 of a lid. Consequently, the lid 52 for press will be held at the carrier housing 46.

[0034]

And as the carrier unit 40 mentioned above, where hold section 32A is equipped, a trial will be performed in a predetermined ambient atmosphere to a bare chip 60.

[0035]

Repeat use of the above contact sheets 44 will be carried out in such a trial to the new bare chip 60 with which it is equipped with a predetermined number.

[0036]

Before presenting such a trial, each bump 44B has the approximate circle drill-like configuration so that it may be expanded to drawing 5 (A) and may be shown at the beginning. Moreover, as the latest section of bump 44B is expanded and it is shown in it at drawing 6 (A), minute concavo-convex 44a is formed in the whole front face.

[0037]

Next, the latest section of bump 44B will have predetermined crushing cost, and will be contacted by the electrode surface of a bare chip 60 by the predetermined pressure so that it may be expanded to drawing 5 (B) and drawing 6 (B) and may be shown, when a trial is presented with the contact sheet 44.

[0038]

Then, by carrying out repeat use of the contact sheet 44 of one sheet to the bare chip 60 of a predetermined number, the latest section of each bump 44B' is crushed, and serves as the approximate circle frustum configuration of having a flat side so that it may be expanded to drawing 5 (C) and drawing 6 (C) and may be shown. Flatness side 44fs with such each smooth bump 44B' does not have minute irregularity as shown in drawing 6 (A).

[0039]

Therefore, when used more than the count of predetermined, without being exchanged in the contact sheet 44 of one sheet, there is a possibility that the electrical installation the contact sheet 44 and between bare chip 60 may become uncertain.

[0040]

Then, in the 1st example of the recovery approach of the electrode concerning this invention, the imprint plate 10 which has predetermined thickness as shown in drawing 1 (A) beforehand is prepared. The imprint plate 10 is made from the tool steel between the colds (JIS notation SKS, SKD) (coefficient of linear expansion: about  $11.5 \times 10^{-6}$ /degree C) which carried out plating processing as surface treatment with chromium (coefficient of linear expansion: about  $6.2 \times 10^{-6}$ /degree C), and at least, as it is expanded to drawing 2 (A) and shown in 10s of imprint sides of one side, it has concavo-convex 10a of predetermined granularity.

[0041]

First, as shown in drawing 1 (A), while the contact sheet 44 with which the bump was worn out is arranged, the above-mentioned carrier unit 40 equipped with the imprint plate 10 instead of the bare chip 60 is arranged in the thermostat 12 which maintains whenever [ predetermined room air temperature ]. It shall have a thermostat 12 in the heat regulator which can adjust indoor temperature to adjustable.

[0042]

The imprint plate 10 is laid on the common flat surface formed of two or more flatness side 44fs (es) so that 10s of the imprint side may contact flatness side 44fs in which each bump 44B' in a thermostat 12 was worn out in that case. Therefore, the imprint plate 10 will be supported by flatness side 44fs of two or more bump 44B'. It is pressurized by the energization force of a spring 54 by the predetermined pressure along the direction which the arrow head F shown in drawing 1 (A) shows through the press object 56 in that case. The welding pressure is set as the range of one bump 44B per 1g or more abbreviation [ 100g or less ]. When it is less than 1g of bump 44B per abbreviation whose welding pressure is one piece according to verification by the artificer of this application, per [ whose welding pressure there is almost no effectiveness of recovery and is one piece / bump 44B ], when exceeding 100g, and the protrusion height of bump 44B becomes lower than criteria too much and crushing of the tip of bump 44B serves as size comparatively Since it was checked that the problem of exerting comparatively big damage on the electrode of an inspected object arises, the welding pressure is set as the range of one bump 44B per 1g or more abbreviation [ 100g or less ].

[0043]

Drawing 3 (B) expands the condition of the point of bump 44B' immediately after 10s of imprint



sides having contacted flatness side 44fs, and pressurizing them, and is shown. By this, the point of bump 44B' will be pressed by concavo-convex 10a of the imprint plate 10, and comparatively coarse concavo-convex 44ps will be formed so that clearly from drawing 3 (B).

[0044]

Next, the temperature in a thermostat 12 is made to go up by the range from reference condition to [ from 80 degrees C or more ] 150 degrees C, and is maintained 5 minutes or more. In addition, the temperature and the period to maintain in a thermostat 12 are preferably set up in about 15 minutes at the room temperature of 150 degrees C.

[0045]

Therefore, the imprint plate 10 and the contact sheet 44 [ when it expands in the direction which the arrow head E of drawing 1 (A) shows along with the temperature rise of a room temperature, respectively ] Since the coefficient of thermal expansion of base material 44M is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 44 will resist mutual frictional force concavo-convex 44ps and 10s of imprint sides shown in drawing 3 (B), and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the field in which concavo-convex 44ps is formed will be further deleted by relative sliding of about dozens of micrometers to minute irregularity of contact sheet 44 and 10s of imprint sides of bump 44B' 10a, and 44ms of irregularity of granularity with the finer surface roughness as shown in drawing 3 (C) will be formed.

[0046]

Then, as contact sheet 44'' which has bump 44B'' by which recovery was carried out is shown in drawing 1 (B), it is taken out from the carrier unit 40.

[0047]

Therefore, 44ms of comparatively detailed irregularity corresponding to the press and sliding of minute concavo-convex 10a of 10s of imprint sides in the imprint plate 10 will be formed in the latest field 44es of bump 44B'', without applying comparatively big thrust so that it may be expanded to drawing 2 (B) and drawing 3 (D) and may be shown.

[0048]

Moreover, as mentioned above, by heating, since it becomes easy to transform bump 44B, formation of above-mentioned irregularity becomes easier.

[0049]

Drawing 4 (A), (B), and (C) show the condition of each process of bump 44B' in the example of a comparison verified by the artificer of the invention in this application, respectively.

[0050]

In the example of a comparison, it considers only as what the contact sheet 44 with which bump 44B' as expanded to drawing 4 (A) like an above-mentioned example and shown in the above-mentioned carrier unit 40 was worn out is arranged, and is equipped with the imprint plate 10 same instead of being a bare chip 60 as mentioned above, without being heated like an above-mentioned example in performing recovery of an electrode.

[0051]

In this example of a comparison, bump 44B' is pressurized with the imprint plate 10 by the same predetermined pressure as an above-mentioned example along the direction which the arrow head F shown in drawing 1 (A) shows according to the energization force of a spring 54 through the press object 56. Drawing 4 (B) expands the condition of the point of bump 44BC immediately after 10s of imprint sides having contacted flatness side 44fs, and pressurizing them, and is shown. By this, the point of bump 44BC will be pressed by concavo-convex 10a of the imprint plate 10, and comparatively coarse concavo-convex 44ps will be formed so that clearly from drawing 4 (B).

[0052]

Next, the contact sheet which has bump 44BC by which recovery was carried out is taken out from the carrier unit 40.

[0053]

Therefore, comparatively coarse concavo-convex 44ps corresponding to the press of minute concavo-convex 10a of 10s of imprint sides in the imprint plate 10 will be formed in the latest



field of bump 44BC so that it may be expanded to drawing 4 (C) and may be shown.

[0054]

Consequently, in the approach of the example of a comparison, it was checked that 44ms of comparatively detailed irregularity which is obtained in the example 1 of this application is not formed.

[0055]

In addition, in the invention in this application, effectiveness which applied the file to the connection side of bump 44B will be acquired by relative sliding between 10s of imprint sides and bump 44B which were mentioned above, moreover, as compared with the case where it imprints only by press, spacing of the irregularity will be more narrow, and irregularity will be formed certainly.

[0056]

Drawing 10 (A), (B), and (C) show typically each process in the 2nd example of the recovery approach of the electrode concerning this invention.

[0057]

Drawing 10 (A) The contact sheet 80 used for the example shown in – (C) has two or more bump 84B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 84M, as shown in drawing 10 (A). The tip of each of that bump 84B has projected only predetermined height from the front face of base material 84M. Minute concavo-convex 84a is formed in the whole front face at the tip so that it may be expanded to drawing 11 (A) and may be shown.

[0058]

Each bump 84B is electrically connected to the pad (un-illustrating) through conductor-layer 84C made from copper foil. The pad is formed in the both ends which project towards the exterior from the both ends of the above base members 42 in base material 84M, respectively. Each bump 84B is formed in the gold (Knoop hardness: 80–200) or copper (Knoop hardness: 250–320) used as a base material in the shape of an approximate circle drill with the ingredient with which the predetermined crystal object 86 was mixed by abbreviation homogeneity.

[0059]

When a base material is gold, the crystal object 86 has the degree of hardness which consists of a golden degree of hardness size, is made from PARAJUUMU (Pd) with a particle diameter [ with comparatively high electrical conductivity ] of about 2–3 micrometers, and (Knoop hardness:250–350), and is mixed with the content of about 15 – 20% / vol extent.

[0060]

Moreover, when a base material is copper, the crystal object 86 has the degree of hardness which consists of a copper degree of hardness size, is made from nickel (nickel) with a particle diameter [ with comparatively high electrical conductivity ] of about 2–3 micrometers, and (Knoop hardness:300–490), and is mixed with the content of about 15 – 20% / vol extent.

[0061]

Base material 84M are made for example, from a polyimide resin ingredient (coefficient of linear expansion:  $35 \times 10^{-6}$ /degree C) in the shape of sheet metal, and have the thickness of about 40 micrometers.

[0062]

In carrying out recovery of the bump 84B as an electrode of this contact sheet 80, it is the basis arranged as mentioned above in the carrier unit 40 with the above-mentioned contact sheet 80 of one sheet, and recovery of the connection side at the tip of bump 84B will be automatically carried out by carrying out repeat use to a bare chip 60. Therefore, the press process and heating process of the imprint plate 10 used in the 1st above-mentioned example are made unnecessary.

[0063]

That is, the latest section of bump 84B will have predetermined crushing cost, and will be contacted by the electrode surface of a bare chip 60 by the predetermined pressure so that it may be expanded to drawing 10 (B) and drawing 11 (B) and may be shown, when a trial is presented with the contact sheet 80 in the carrier unit 40.

[0064]

then, by carrying out repeat use of the contact sheet 80 of one sheet to the bare chip 60 of a predetermined number, the latest section of each bump 84B' crushes so that it may be expanded to drawing 10 (C) and drawing 11 (C) and may be shown — having — abbreviation — it becomes the approximate circle frustum configuration of having a flat field. As shown in drawing 11 (C), minute irregularity will be formed in apical surface 84fs of such each bump 84B' when some of two or more crystal objects 86 contained by wear of a base material are exposed.

[0065]

Therefore, a field with new minute irregularity will be automatically formed in the latest section of each bump 84B' with wear of the base material of the latest section of each bump 84B'.

[0066]

In the carrier unit 40 used for the 1st example of the recovery approach of the electrode concerning above-mentioned this invention, only the predetermined range is supported relatively [ front face / of the base member 42 ] movable to abbreviation parallel by the part in which two or more bump 44B which can be set on the contact sheet 44 is formed.

[0067]

However, the carrier unit which the structure of the carrier unit 40 does not necessarily need to be made in this way, for example, is shown in drawing 12 (A), (B) – drawing 14 (A), and (B) may be used.

[0068]

In drawing 12 (A) a carrier unit The carrier housing 47 which has hold section 47A in which a bare chip 60 or the imprint plate 10 is held like an above-mentioned example, The base member 43 which forms the pars basilaris ossis occipitalis of hold section 47A of the carrier housing 47, The contact sheet 45 arranged through the elastic sheet 41 on the base member 43, It is constituted including the lid 52 for press which comes to contain the press object which presses the electrode group or the imprint plate 10 of a bare chip 60 to bump 45B of the contact sheet 45, and the ratchet mechanism 49 which holds the lid 52 for press alternatively in the carrier housing 47. In addition, since the structures of the lid 52 for press and a ratchet mechanism 49 are a lid for press in the 1st above-mentioned example, and the structure and identitas of a ratchet mechanism, they omit the duplication explanation.

[0069]

The carrier housing 47 is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion:  $56 \times 10^{-6} / \text{degree C}$ ) is desirable, for example. As shown in drawing 12 (B), when being equipped with the lid 52 for press, the inner circumference section of hold section 47A of the carrier housing 47 is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. Hole 47a by which the conclusion member 51 later mentioned around central opening 47b is inserted in the bottom surface part of hold section 47A of the carrier housing 47 is formed in four places.

[0070]

The contact sheet 45 has two or more bump 45B in the array corresponding to the electrode group of the bare chip 60 connected electrically in base material 45M. For example, only height predetermined [ front face / of the copper used as a base material / the front face of base material 45M to ] in nickel and the tip of each bump 45B which gold plate processing is carried out and is formed is projected. Base material 45M are made for example, from a polyimide resin ingredient (coefficient of linear expansion:  $35 \times 10^{-6} / \text{degree C}$ ) in the shape of sheet metal, and have the thickness of about 40 micrometers.

[0071]

Each bump 44B is connected to pad 45p through the conductor layer made from copper foil. Two or more pad 45p is formed in the both ends which project towards the exterior from the both ends of the base member 43 in base material 45M, respectively.

[0072]

The contact sheet 45 has hole 45a in which the conclusion member 51 is inserted corresponding

to hole 47a of the carrier housing 47 around two or more bump 44B.

[0073]

The base member 43 is fabricated with the same ingredient as the ingredient of the carrier housing 47, and has hole 43a corresponding to hole 47a of the carrier housing 47, and hole 45a of the contact sheet 45.

[0074]

One of the roles which the elastic sheet 41 arranged just under two or more bump 44B of the contact sheet 45 plays is making into homogeneity dispersion in the contact force of bump 45B which originates in the protrusion height of each bump 45B like an above-mentioned example.

[0075]

As shown in drawing 12 (B), as a conclusion member 51 which concludes the carrier housing 47 and the base member 43 of each other on both sides of the contact sheet 45, a rivet or a screw, and a nut are desirable, for example.

[0076]

When such a carrier unit is used, while the contact sheet 45 with which the bump was worn out is first arranged like the 1st above-mentioned example in a bump's recovery, the above-mentioned carrier unit equipped with the imprint plate 10 instead of the bare chip 60 is arranged in the thermostat 12 which maintains whenever [ predetermined room air temperature ].

[0077]

The conditions of thrust are set up like the 1st above-mentioned example.

[0078]

Next, the temperature in a thermostat 12 is made to go up by the range from reference condition to [ from 80 degrees C or more ] 150 degrees C, and is maintained 5 minutes or more. In addition, the temperature and the period to maintain in a thermostat 12 are preferably set up in about 15 minutes at the room temperature of 150 degrees C.

[0079]

Therefore, the imprint plate 10, and the base member 43, the carrier housing 47 and the contact sheet 45 [ when it expands along with the temperature rise of a room temperature, respectively ] Since the coefficient of linear expansion of carrier housing 47 grade is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0080]

Drawing 13 (A) and (B) show other carrier units used for an example of the recovery approach of the electrode concerning this invention, respectively.

[0081]

In the carrier unit shown in drawing 12 (A) and (B), although the carrier housing 47 and the base member 43 of each other are concluded by the conclusion member 51 on both sides of the contact sheet 45 instead, in drawing 13 (A) and (B), the carrier housing 47 and the base member 43 of each other are joined on both sides of the contact sheet 45 by adhesives or fusion welding. In addition, in drawing 13 (A) and (B), the same sign is attached and shown about the component made the same in drawing 12 (A) and (B), and the duplication explanation is omitted.

[0082]

Carrier housing 47' is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion:  $56 \times 10^{-6} / \text{degree C}$ ) is desirable, for example. As shown in drawing 13 (B), when being equipped with the lid 52 for press, the inner circumference section of hold section 47'A of carrier housing 47' is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. In the bottom surface part which forms the base of hold section 47'A of carrier housing 47', opening 47'b is formed in the center.

[0083]



Base member 43' is fabricated with the same ingredient as the ingredient of carrier housing 47', and has gage pin 43'P in four places respectively corresponding to hole 45a of the contact sheet 45. Gage pin 43'P has projected predetermined die length, for example, thickness extent of the contact sheet 45, to the field where the elastic sheet 41 is arranged. Let locator-pin 43'P be a thing for carrying out the variation rate of the contact sheet 45 similarly according to the thermal expansion of base member 43', or the variation rate of contraction while it positions the relative position to base member 43' of the contact sheet 45. the base — a member — 43 — ' — — a carrier — housing — 47 — ' — hold — the section — 47 — ' — A — receiving — a relative position — fusion welding — the time — positioning — having .

[0084]

Also in this example the imprint plate 10, and base member 43', and carrier housing 47' and the contact sheet 45 [ when it expands along with the temperature rise of a room temperature, respectively ] Since coefficient of linear expansion, such as carrier housing 47', is set as size rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0085]

drawing 14 (A) and (B) are used for an example of the recovery approach of the electrode concerning this invention, respectively — being the further — others — a carrier unit is shown.

[0086]

the carrier unit shown in drawing 13 (A) and (B) — setting — the contact sheet 45 — inserting — carrier housing 47' and a locator pin 43, although the 'base member 43 which has P' of each other is joined instead — drawing 14 — (— A —) — and — (— B —) — setting — adhesives — or — fusion welding — contact — a sheet — 45 — inserting — a locator pin — 47 — " — P — having — a carrier — housing — 47 — " — the base — a member — 43 — " — mutual — joining — having — a thing — \*\* — carrying out — having . In addition, in drawing 14 (A) and (B), the same sign is attached and shown about the component made the same in drawing 12 (A) and (B), and the duplication explanation is omitted.

[0087]

Carrier housing 47'' is fabricated with the ingredient which has the coefficient of linear expansion which consists of coefficient of linear expansion of the above-mentioned imprint plate 10 size, for example, a resin ingredient. As a resin ingredient, polyether imide (coefficient of linear expansion:  $56 \times 10^{-6} / \text{degree C}$ ) is desirable, for example. As shown in drawing 14 (B), when being equipped with the lid 52 for press, the inner circumference section of carrier housing 47'' hold section 47'' A is formed so that the periphery section of the lid 52 for press may be guided and it may position in a predetermined location. In the bottom surface part of carrier housing 47'' hold section 47'' A, opening 47''b is formed in the center. In the surrounding external surface of opening 47''b, gage pin 47''P has projected at four places respectively corresponding to hole 45a of the contact sheet 45. Gage pin 47''P has projected predetermined die length, for example, thickness extent of the contact sheet 45, to the base. Let locator-pin 47''P be a thing for carrying out the variation rate of the contact sheet 45 similarly according to the thermal expansion of carrier housing 47'', or the variation rate of contraction while it positions the relative position to carrier housing 47'' of the contact sheet 45. The relative position to base member 43'' of hold section 47'A of carrier housing 47'' is positioned at the time of fusion welding.

[0088]

Base member 43'' is fabricated with the same ingredient as the ingredient of carrier housing 47''.

[0089]

Also in this example the imprint plate 10, and base member 43'', and carrier housing 47'' and the contact sheet 45 [ when it expands along with the temperature rise of a room temperature, respectively ] Since coefficient of linear expansion, such as carrier housing 47'', is set as size



rather than the coefficient of linear expansion of the imprint plate 10 as mentioned above, the contact sheet 45 will resist mutual frictional force 10s of imprint sides, and will be relatively prolonged in size as compared with the elongation of the imprint plate 10. Consequently, the irregularity of granularity with the finer surface roughness will be formed at the tip of each bump 45B like the 1st above-mentioned example.

[0090]

Drawing 15 and drawing 16 show roughly the configuration of the carrier unit stage used for the 3rd example of the recovery approach of the electrode concerning this invention, respectively with the imprint plate fixed head.

[0091]

In addition, in drawing 15 and drawing 16, the same sign is attached and shown about the component made the same in the carrier unit in the example shown in drawing 7 and drawing 8, and the duplication explanation is omitted. Moreover, in drawing 15 and drawing 16, the condition that some components of the carrier unit in the condition that the lid for press was removed were held in the carrier unit stage is shown.

[0092]

As the part is shown in drawing 15 and drawing 17, a carrier unit The carrier housing 116 which has hold section 116A in which a bare chip 60 is held, The contact sheet 44 arranged through the elastic sheet 110 on the base member 108 which forms the pars basilaris ossis occipitalis of hold section 116A of the carrier housing 116, It is constituted including ratchet-mechanism 116F which hold alternatively the lid for press which comes to contain the press object which presses the electrode group of a bare chip 60 to bump 44B of the contact sheet 44, and (un-illustrating) and its lid for press in the carrier housing 116.

[0093]

In addition, the above-mentioned lid for press which is not illustrated is equipped with the configuration in the example shown in drawing 8, and the same configuration.

[0094]

Ratchet-mechanism 116F are constituted by the both ends of the carrier housing 116 as shown in drawing 7 including the hook member which is supported rotatable with a support shaft and holds the edge of the lid for press, and the coil spring which energizes a hook member in the direction made to engage with the edge of the lid for press, respectively, respectively.

[0095]

The carrier unit stage 106 has hold section 106A which holds the carrier housing 116 temporarily in the recovery of bump 44B of the contact sheet 44. As shown in drawing 15 and drawing 17, in order to regulate the relative position to hold section 106A of the base member 108, the inner circumference section of hold section 106A which carries out opening towards the upper part is formed so that it may engage with the edge of the base member 108.

[0096]

As shown in drawing 16 and drawing 17, the ratchet mechanism of the pair held removable in hold section 106A carries out phase opposite of the carrier housing 116 of a carrier unit, and it is prepared in the periphery section of hold section 106A. The ratchet mechanism is constituted by the wall which forms hold section 106A in the carrier unit stage 106 including the hook member 112 which is supported rotatable with the support shaft 118 and holds the periphery section of hold section 116A of the carrier housing 116, and the coil spring 114 which energizes the hook member 112 in the direction made to engage with the periphery section of hold section 116A, respectively, respectively.

[0097]

As shown to drawing 17 by the two-dot chain line, the end resists the energization force of a coil spring 114, and when equipped only with the carrier housing 116 of a carrier unit in hold section 106A, or when being removed from hold section 106A, the hook member 112 is rotated so that it may be isolated out of hold section 106A. On the other hand, when the carrier housing 116 is held in hold section 106A, the end of the hook member 112 is contacted by the periphery section of hold section 116A of the carrier housing 116 according to the energization force of a coil spring 114, as shown in drawing 15 and drawing 17.

[0098]

When recovery is performed about the contact sheet 44 with which the bump was worn out so that it may mention later, the imprint plate fixed head is arranged in hold section 116A of the carrier housing 116 in a carrier unit, as shown in drawing 15.

[0099]

The press object 102 which has fixed side 102a to which the imprint plate 104 is fixed as the imprint plate fixed head is shown in drawing 15, The body 100 of a lid which has the crevice in which the base of the press object 102 is held, It is allotted to each space between the crevice of the base of the press object 102, and the comparatively deep crevice of the body 100 of a lid, respectively, and is constituted including two or more springs 103 which turn the imprint plate 104 to bump 44B of the contact sheet 44, and energize it.

[0100]

The base of the press object 102 is inserted movable into the comparatively shallow large crevice of the body 100 of a lid. 102n of claw parts which engage with the claw part prepared in the lower limit of the body 100 of a lid carries out phase opposite, and they are formed in the edge of a part at which the press object 102 is inserted. [ two or more ] By this, the press object 102 will be held at the body 100 of a lid in the condition of having been energized by the energization force of two or more springs 103.

[0101]

One field of the imprint plate 104 made from a metallic material or a ceramic ingredient is being fixed by adhesion or the conclusion implement to fixed side 102a. Irregularity with predetermined flatness and predetermined surface roughness is formed in the field of another side of the imprint plate 104. In addition, the imprint plate 104 may be formed in the press object 102 and one, without being restricted to this example. Moreover, the press object 102 may be formed in the body 100 of a lid, and one, for example, without two or more springs 103 intervening.

[0102]

On the other hand, the lid for press of a carrier unit (un-illustrating) is held by the ratchet-mechanism 116F at the carrier housing 116, when a trial is performed to a bare chip 60.

[0103]

100s of female screw sections in which the male screw section of the load cell mentioned later is inserted is prepared in the abbreviation center section of the upper part of the body 100 of a lid.

[0104]

Drawing 18 shows roughly the whole sliding equipment configuration to which the contact sheet 44 is relatively moved to the imprint plate fixed head in the process of the recovery about bump 44B of the contact sheet 44.

[0105]

sliding equipment be constitute including the table device section which make it move in the predetermined direction, and the pressurization device section which the imprint plate fixed head be hold [ section ] and make a predetermined pressure act on bump 44B of the imprint plate 104 and the contact sheet 44 while fix the carrier unit stage 106 holding the carrier housing 116 with which it be allot on the base member 120, and the contact sheet 44 be hold.

[0106]

The pedestal 122 matched with the table device section on the base member 120, and X shaft-orientations stage member 126 moved by the ball screw member 124 supported by the pedestal 122, Y shaft-orientations stage member 130 moved in the direction of an axis of the ball screw member 124 by the ball screw member 132 supported by X shaft-orientations stage member 126 along the direction which carries out an abbreviation rectangular cross, It is constituted including the rotation stage 136 which is supported rotatable by the stage supporter 134 allotted to Y shaft-orientations stage member 130, and holds a carrier unit.

[0107]

A pedestal 122 consists of a handstand surface part which carries out breadth extension in the direction which an arrow head Z shows to an abbreviation perpendicular to the flat part formed along the direction which the arrow head X in drawing 18 shows, and a flat part.

[0108]

X shaft-orientations stage member 126 is guided with a guide rail 168, and is supported by the ball screw member 124 movable through the nut. The both ends of the ball screw member 124 are supported by the edge which met in the direction which an arrow head X shows in drawing 18 in the flat part of a pedestal 122, respectively. The output shaft of the drive motor 160 fixed to a pedestal 122 through moderation device 160GH, such as an epicyclic gear device, is connected with one edge of the ball screw member 124. In addition, as for a drive motor 160, a linear motor, a stepping motor, a servo motor, etc. may be used. A drive motor 160 and each drive motor mentioned later are controlled by the control unit 150 mentioned later.

[0109]

Y shaft-orientations stage member 130 is supported by the inner circumference section of X shaft-orientations stage member 126 movable along the perpendicular direction at space with the guide rails 128A and 128B by which pair opposite arrangement is carried out. Moreover, Y shaft-orientations stage member 130 is supported by the ball screw member 132 movable through the nut. The both ends of the ball screw member 132 are supported by the edge which met perpendicularly in drawing 18 in X shaft-orientations stage member 126 at space, respectively. The output shaft of the drive motor 162 fixed to X shaft-orientations stage member 126 through moderation devices, such as an epicyclic gear device, is connected with one edge of the ball screw member 132. As for a drive motor 162, a linear motor, a stepping motor, a servo motor, etc. may be used.

[0110]

The drive motor 164 is being fixed to the center section of the stage supporter 134 fixed to the top face of Y shaft-orientations stage member 130. The stage supporter 134 is being fixed to the top face of Y shaft-orientations stage member 130 through the notch of X shaft-orientations stage member 126. It connects with the output shaft of a drive motor 164 inside the center of the disk section of the rotation stage 136 through moderation device 164GH. The side attachment wall of the rotation stage 136 is supported by the upper part of the stage supporter 134 rotatable through bearing 137. As for a drive motor 164, a linear motor, a stepping motor, a servo motor, etc. may be used.

[0111]

This will rotate the rotation stage 136 to the circumference of the medial-axis line of Y shaft-orientations stage member 130, and the medial-axis line of the stage supporter 134, when a drive motor 164 is made into an operating state.

[0112]

The carrier unit stage 106 is being fixed by the conclusion member to which illustration is abbreviated, for example, a \*\*\*\* member etc., to the disk section of the rotation stage 136.

[0113]

The pressurization device section is constituted including Z shaft-orientations stage member 140 which transmits thrust to the imprint plate fixed head, the ball screw member 142 which it is inserted in Z shaft-orientations stage member 140, and is supported movable, and the drive motor 166 made to rotate the ball screw member 142 while holding the load cell 138 which detects the thrust to bump 44B through the imprint plate fixed head, and a load cell 138.

[0114]

The both ends of the ball screw member 142 are supported by the bracket section of the pair prepared in a handstand surface part by having predetermined spacing rotatable, respectively. One edge of the ball screw member 142 is connected with the output shaft of the drive motor 166 fixed to a handstand surface part through moderation device 166GH. As for a drive motor 166, a linear motor, a stepping motor, a servo motor, etc. may be used.

[0115]

Z shaft-orientations stage member 140 is guided with the guide rail 144 so that it may be inserted in so that the ball screw member 142 may serve as an abbreviation perpendicular to the axis through a nut, and it may not rotate.

[0116]

The load cell 138 is connected with the body 100 of a lid by thrusting into 100s of female screw



sections of the imprint plate fixed head 138s of male screw sections connected with the internal sensor section. A load cell 138 sends out the detecting signal Sp which detects the thrust to the imprint plate fixed head of Z shaft-orientations stage member 140, and expresses thrust to a control unit 150.

[0117]

The migration direction command signal Sd showing the direction where the reset command signal Sr and the carrier housing 116 showing the instruction which returns the location of each stage member from the host computer for production control with which illustration is omitted to a predetermined criteria location should move to a control unit 150, the recovery initiation command signal Ss, and the detecting signal Sp from the above-mentioned load cell 138 are supplied.

[0118]

Moreover, the control unit 150 equips the interior with the memory section 150 in which the program data for performing the data showing the set point of the thrust to the imprint plate fixed head set up according to the contact sheet 44 or the set point of the movement magnitude of the carrier housing 116 (carrier unit stage 106) and recovery etc. are stored.

[0119]

The value of the thrust is set up according to the magnitude of bump 44B, for example, let it be the range of 1g or more per electrode 100g or less. As an example of the range of the minimum in the value of thrust, it considers as the range of 1g or more per electrode 40g or less.

[0120]

The movement magnitude of the one direction of the carrier housing 116 (carrier unit stage 106) is set up so that bending of the play of each device and the contact sheet 44 etc. may be considered, and it may be set up, for example, the relative movement magnitude of bump 44B may serve as the 1-micrometer or more range of 1mm or less. As an example of the range of the minimum in the relative movement magnitude of bump 44B, it considers as the 1-micrometer or more range of 100 micrometers or less.

[0121]

In the recovery by the 3rd example in the recovery approach of the electrode concerning this invention, first, as shown in drawing 18, the carrier unit stage 106 in which the carrier housing 116 with which the contact sheet 44 with which the bump was worn out is arranged was attached is held at the disk section of the rotation stage 136 in a predetermined criteria location.

[0122]

Next, a control unit 150 sets up the movement magnitude of each stage member so that the movement magnitude of the carrier housing 116 and the carrier unit stage 106 may serve as a predetermined value based on the data in the recovery initiation command signal Ss, the migration direction command signal Sd, and the memory section 150.

[0123]

A control unit 150 sets up the movement magnitude of the Z-axis stage 140 based on the data of the set point of the thrust in a detecting signal Sp and 150m of memory sections in that case.

[0124]

A control unit 150 forms the pulse control signal Cz according to the set-up movement magnitude, and supplies it to the motorised circuit 158. Based on the pulse control signal Cz, a driving signal shall be supplied to the motorised circuit 158.

[0125]

Then, a control unit 150 forms the pulse control signals Cx, Cy, and Cr so that it may move the carrier housing 116 and the carrier unit stage 106 only once [ at least ] according to the set-up movement magnitude, and it supplies them to the motorised circuits 152, 154, and 156, respectively. Based on the pulse control signals Cx, Cy, and Cr, a driving signal shall be supplied to the motorised circuits 152, 154, and 156 to drive motors 160, 162, and 164, respectively.

[0126]

Thereby, only the specified quantity is made to move relatively bump 44B of the contact sheet



44 in the carrier housing 116 in the predetermined direction once to the imprint plate 104.

[0127]

Therefore, the comparatively detailed irregularity corresponding to the press and sliding of an imprint side of minute irregularity in the imprint plate 104 will be formed in the edge at which the bump was worn out, without applying comparatively big thrust like the case of the 1st above-mentioned example. The irregularity is spacing of for example, about 0.1-micrometer or more 50-micrometer or less extent, and is formed in about 0.001-micrometer or more height of 5 micrometers or less. As range of the minimum of the irregularity, it is spacing of about 0.1-micrometer or more 50-micrometer or less extent, and considers as the range of about 0.002-micrometer or more height 3 micrometers or less, for example.

[0128]

Moreover, in this example, since it is not necessary to heat like [ in the case of the 1st example ], control of the amount of sliding in recovery is easy, and it can process comparatively for a short period of time, consequently is more suitable for mass-production nature.

[0129]

And that thrust should be canceled, a control unit 150 forms the pulse control signal Cz, and supplies it to the motorised circuit 158.

[0130]

The carrier housing 116 with which the contact sheet by which recovery was carried out is held is removed from the carrier unit stage 106. In that case, a control unit 150 forms the control pulse signals Cx, Cy, Cr, and Cz, and supplies them to the motorised circuits 152, 154, 156, and 158 so that it may return the location of each stage member to a predetermined criteria location based on the control signal Sr supplied.

[0131]

After being equipped with a bare chip 60 and the lid for press, the hold section of IC socket 30 will be equipped with the removed carrier housing 116 as a carrier unit like an above-mentioned example.

[0132]

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[Translation done.]

\* NOTICES \*

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] (A) and (B) are drawings showing typically each process of the 1st example of the recovery approach of the electrode concerning this invention, respectively.

[Drawing 2] (A) is a fragmentary sectional view with which a bump's point in the process shown in drawing 1 (B) expands (B) partially, is shown [ a bump's point in the process shown in drawing 1 (A) is expanded partially, and is shown, and ], and explanation of each process is presented.

[Drawing 3] (A), (B), (C), and (D) are fragmentary sectional views with which a bump's point in each process of the 1st example of the recovery approach of the electrode concerning this invention is expanded partially, and is shown, respectively, and explanation of each process is presented.

[Drawing 4] (A), (B), and (C) are fragmentary sectional views with which a bump's point in each process of the example of a comparison is expanded partially, and is shown, and explanation of each process of the example of a comparison is presented, respectively.

[Drawing 5] (A), (B), and (C) are drawings with which explanation of each process at which a bump's tip is worn out by use is presented, respectively.

[Drawing 6] A bump's tip which a bump's tip is expanded partially, respectively, and (A), (B), and (C) are shown, and is shown in drawing 5 (A), (B), and (C) is drawing with which explanation of each process worn out by use is presented.

[Drawing 7] It is the fragmentary sectional view showing an example of the socket for semiconductor devices equipped with the contact sheet with which the 1st example and the 2nd example of the recovery approach of the electrode concerning this invention are applied.

[Drawing 8] It is the fragmentary sectional view showing roughly the configuration of the carrier unit in the example shown in drawing 7 .

[Drawing 9] It is a top view in the example shown in drawing 8 .

[Drawing 10] (A), (B), and (C) are the fragmentary sectional views expanding and showing the important section with which explanation of each process of the 2nd example of the recovery approach of the electrode concerning this invention is presented, respectively.

[Drawing 11] (A), (B), and (C) are the fragmentary sectional views expanding and showing some drawings shown in drawing 10 (A), (B), and (C), respectively.

[Drawing 12] (A) is the block diagram decomposing and showing the configuration of an example of other carrier housing used for the 1st example of the recovery approach of the electrode concerning this invention, and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).

[Drawing 13] (A) is used for the 1st example of the recovery approach of the electrode concerning this invention — being the further — others — it is the block diagram decomposing and showing the configuration of an example of carrier housing and a base member, and (B) is the block diagram showing the configuration of the carrier unit containing carrier housing in (A).

[Drawing 14] (A) is used for the 1st example of the recovery approach of the electrode concerning this invention — being the further — others — it is the block diagram decomposing and showing the configuration of an example of carrier housing and a base member, and (B) is

the block diagram showing the configuration of the carrier unit containing carrier housing in (A).  
[Drawing 15] It is the sectional view showing the configuration of the carrier unit stage used for the 3rd example of the recovery approach of the electrode concerning this invention with the imprint plate fixed head.

[Drawing 16] It is a top view in the example shown in drawing 15 .

[Drawing 17] It is the block diagram decomposing and showing the configuration of carrier housing shown in drawing 15 , and a carrier unit stage.

[Drawing 18] It is the block diagram showing the whole sliding equipment configuration used for the 3rd example of the recovery approach of the electrode concerning this invention.

[Description of Notations]

10a Irregularity

10,104 Imprint plate

10s Imprint side

12 Thermostat

44 80 Contact sheet

44B, 44B', 44B'', and 84B and 84B -- ' -- Bump

44a, 44ps, 44ms, 84a Irregularity

44M, 84M Base material

60 Bare Chip

86 Crystal Object

126 X Shaft-Orientations Stage Member

130 Y Shaft-Orientations Stage Member

136 Rotation Stage

140 Z Shaft-Orientations Stage Member

160,162,164 166 Motor for a drive

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[Translation done.]

## \* NOTICES \*

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

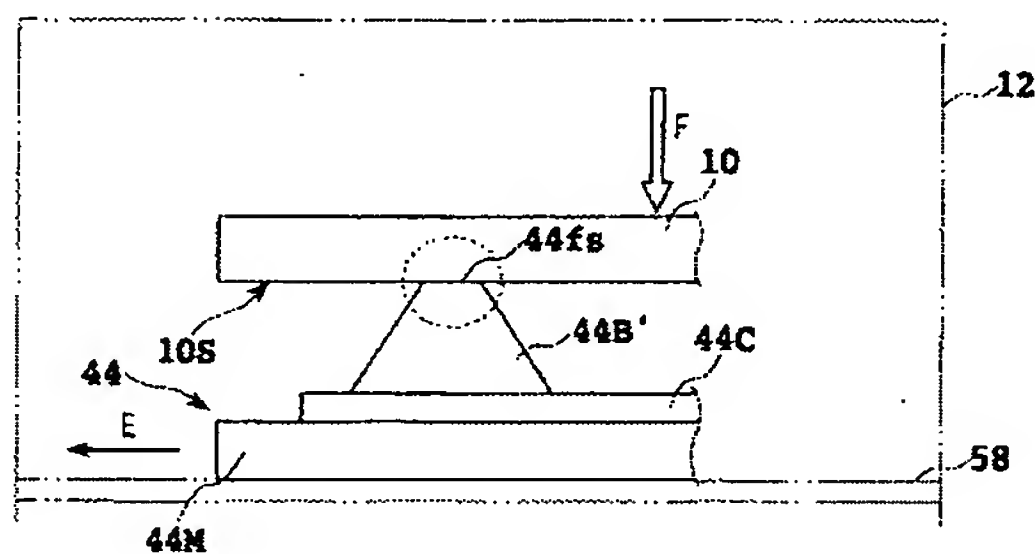
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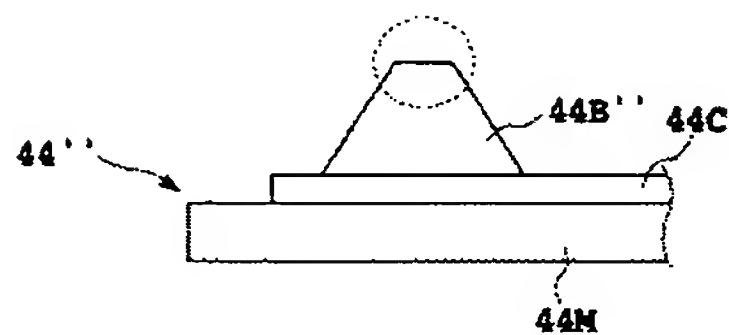
## DRAWINGS

## [Drawing 1]

(A)

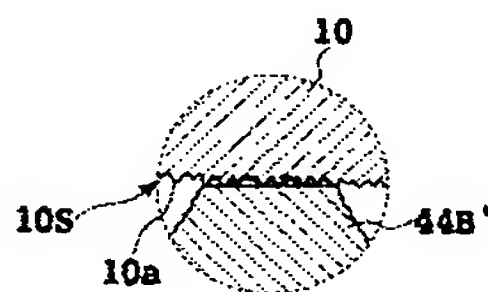


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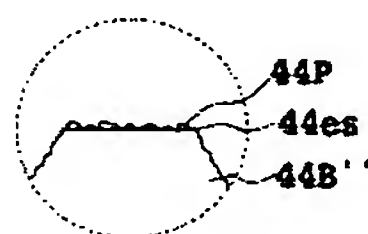


## [Drawing 2]

(A)



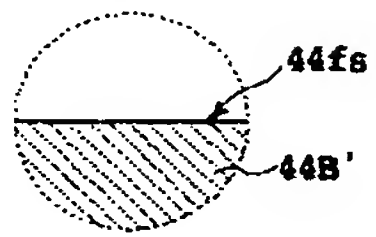
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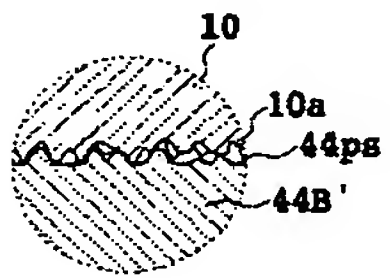
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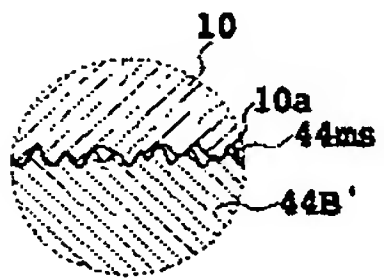
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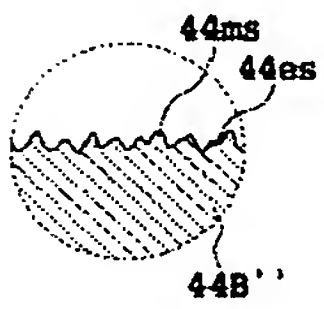
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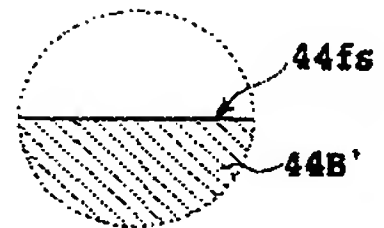
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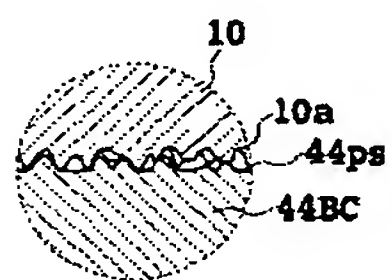
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[Drawing 4]

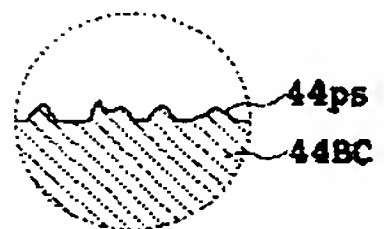
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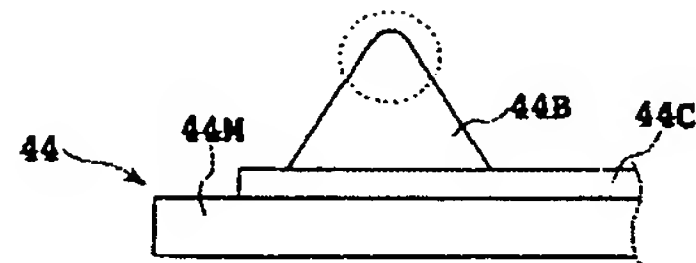
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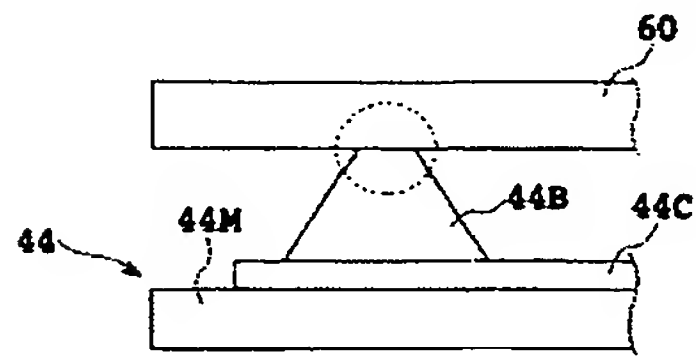
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[Drawing 5]

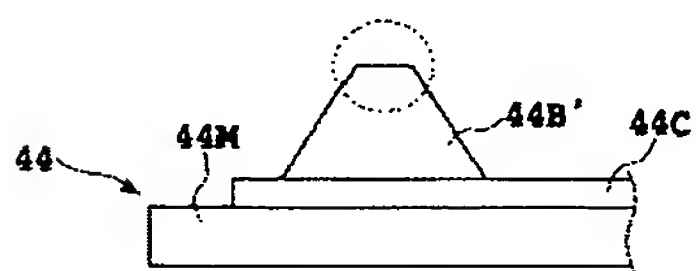
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(B)

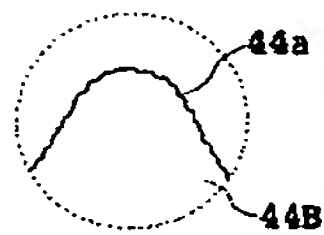


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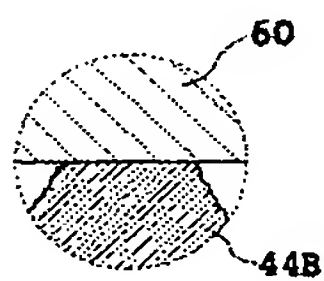


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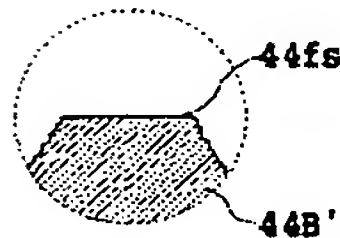
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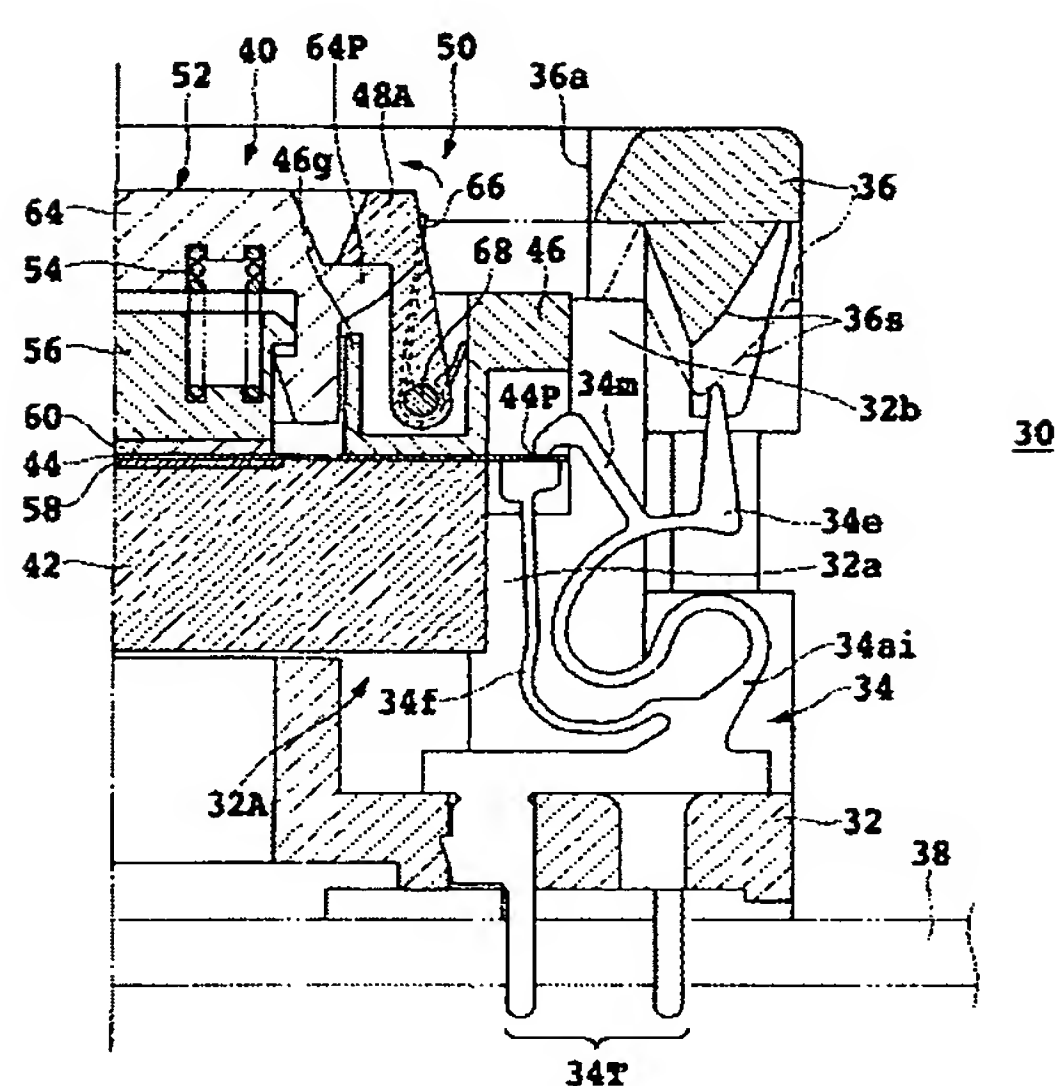
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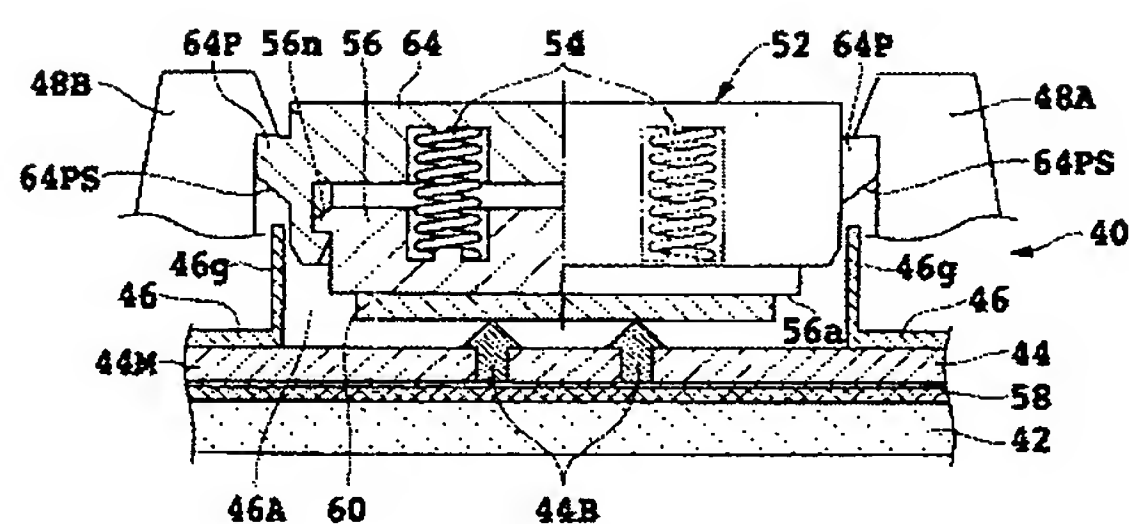
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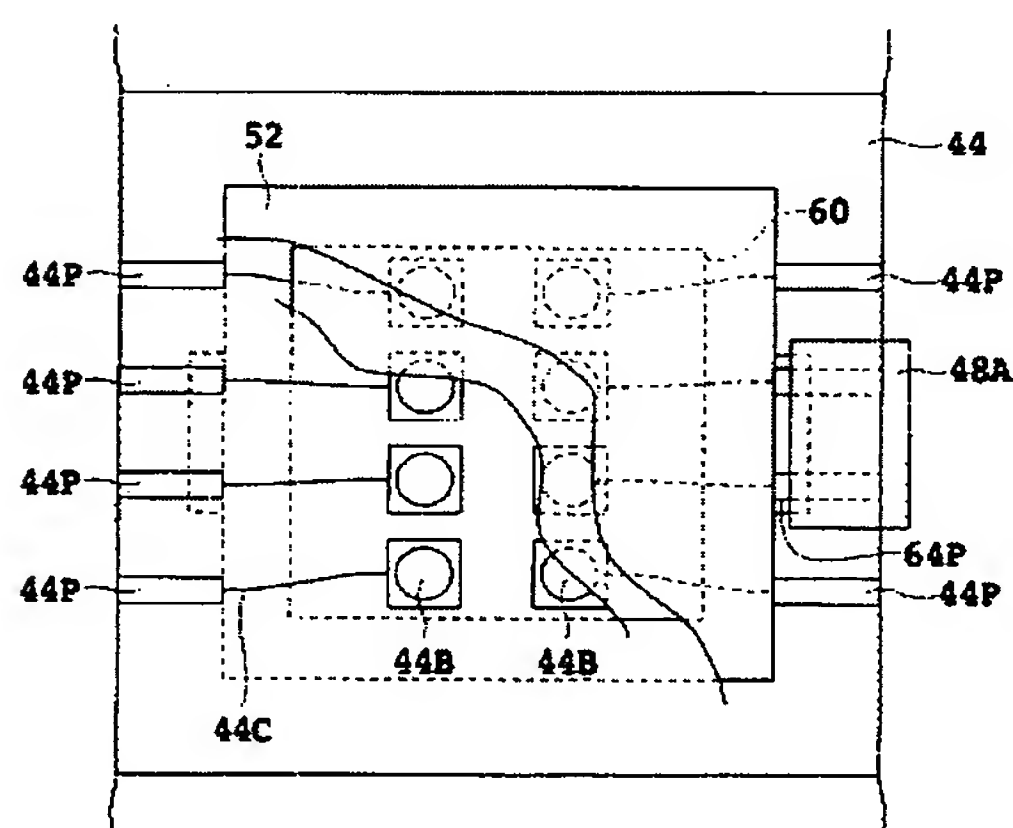
[Drawing 7]



[Drawing 8]

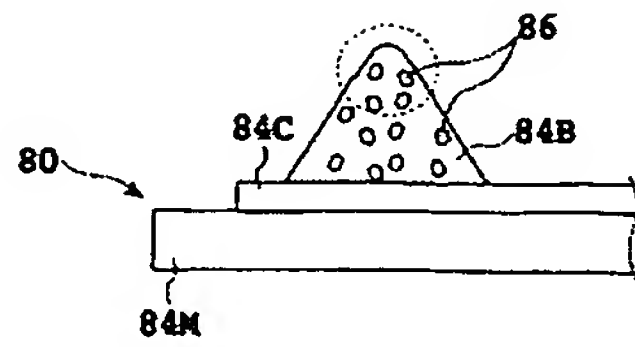


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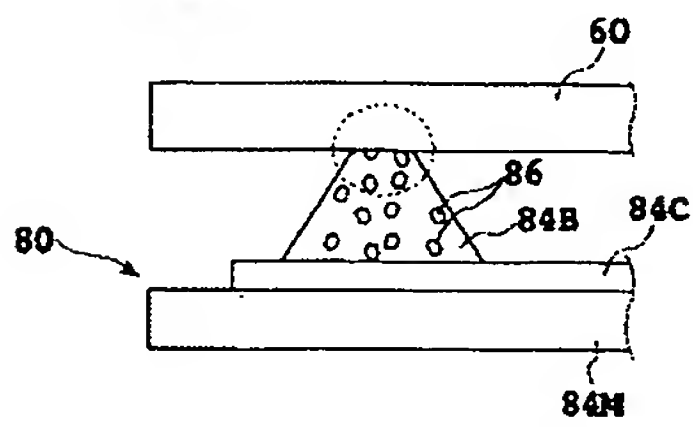


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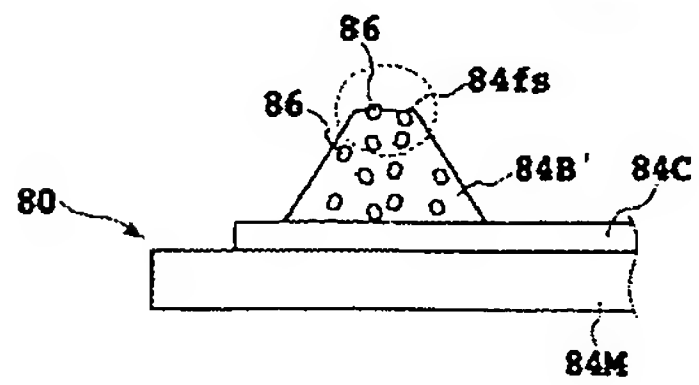
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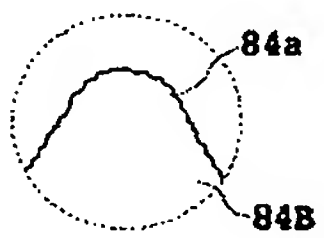
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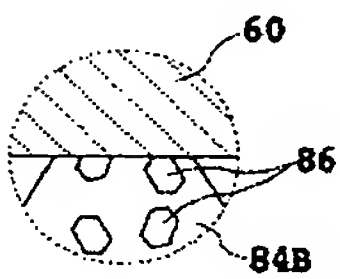
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[Drawing 11]

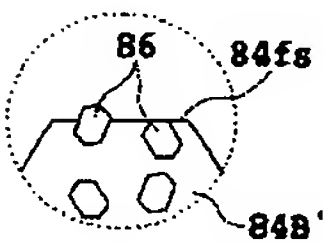
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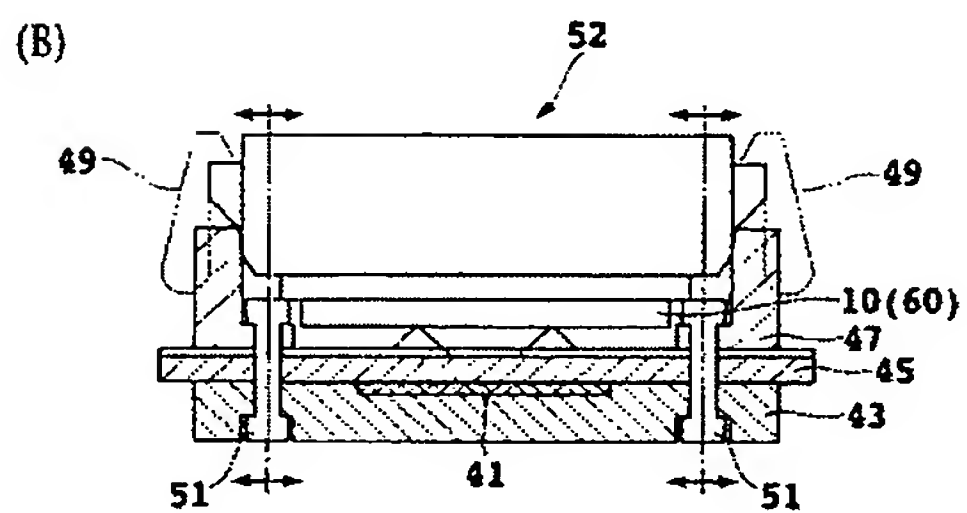
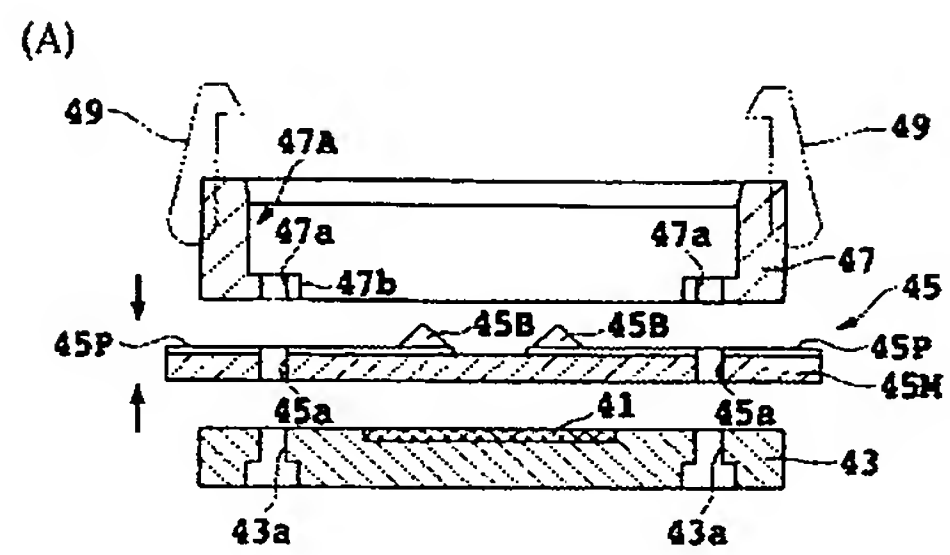
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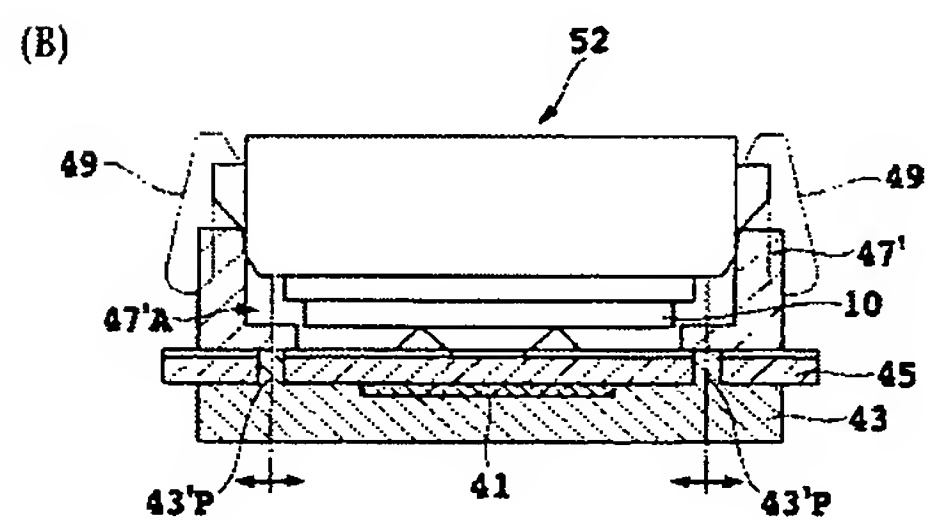
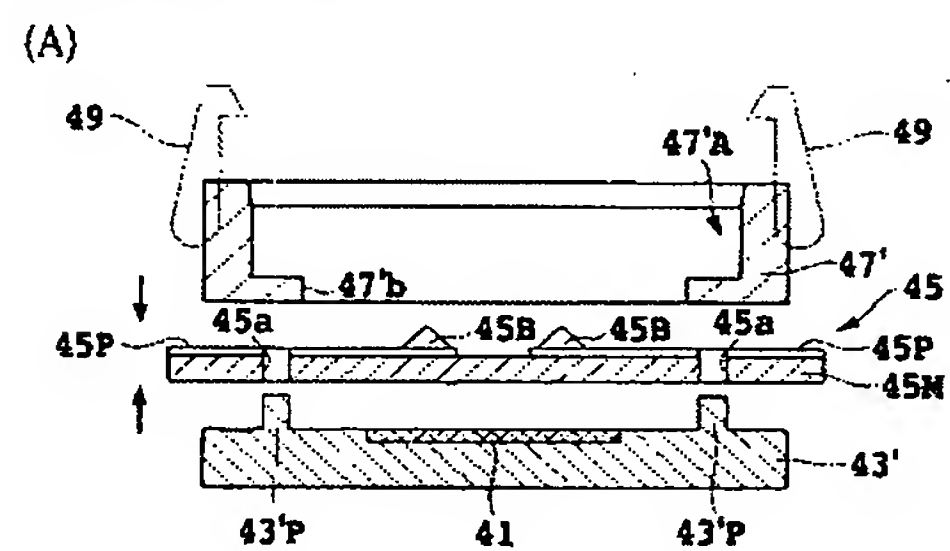
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[Drawing 12]

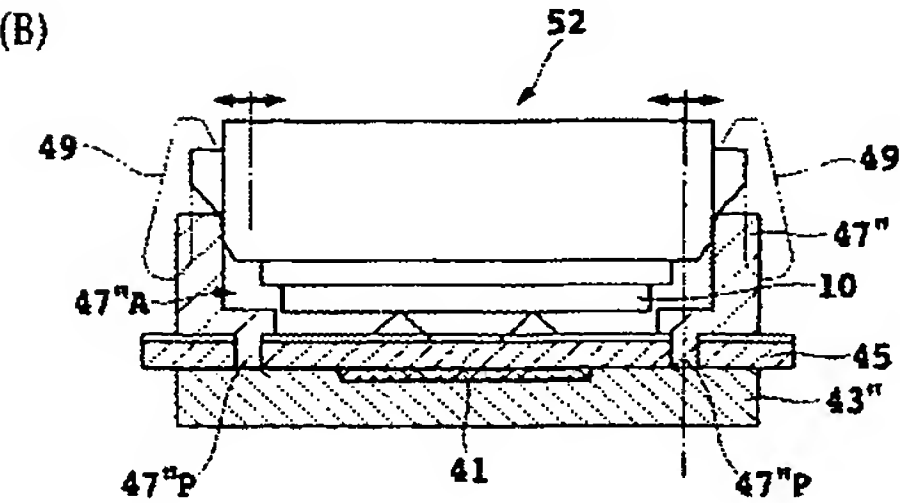
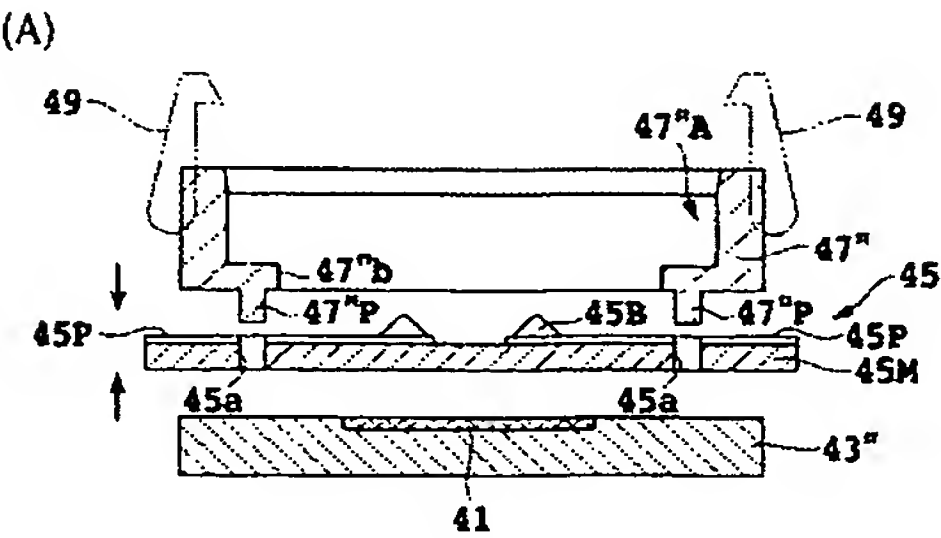




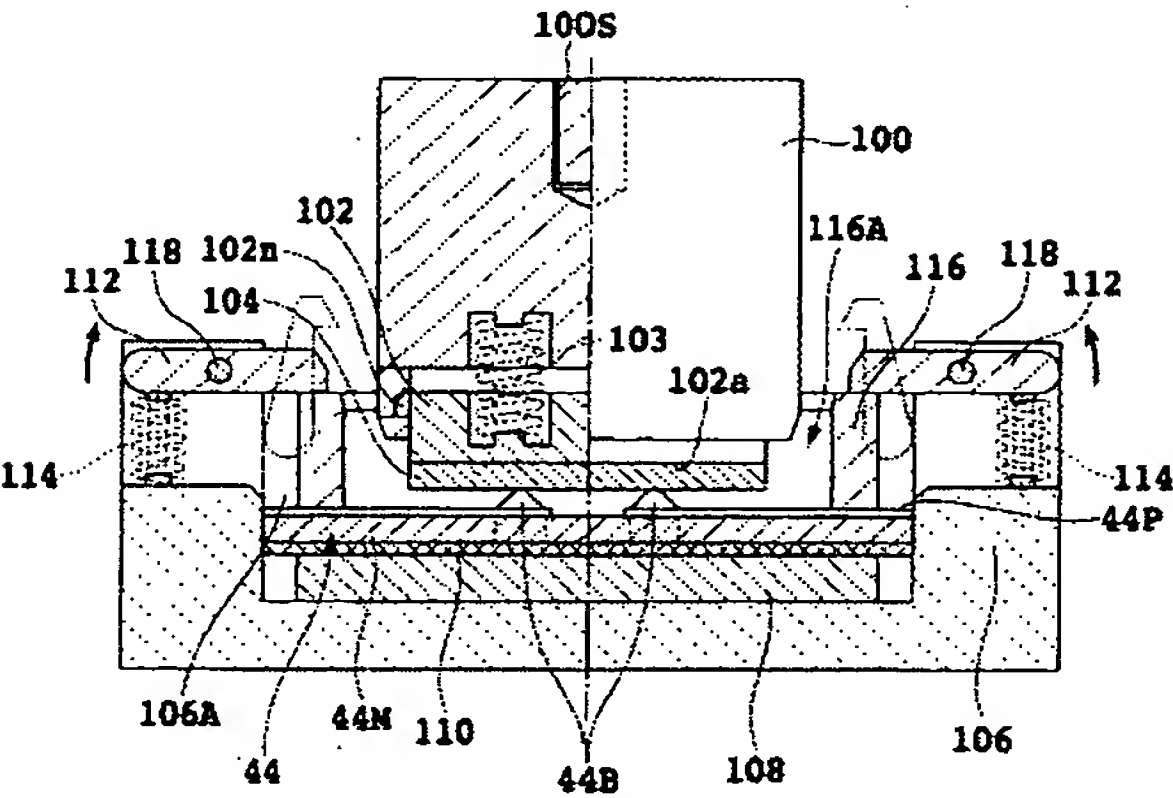
[Drawing 13]



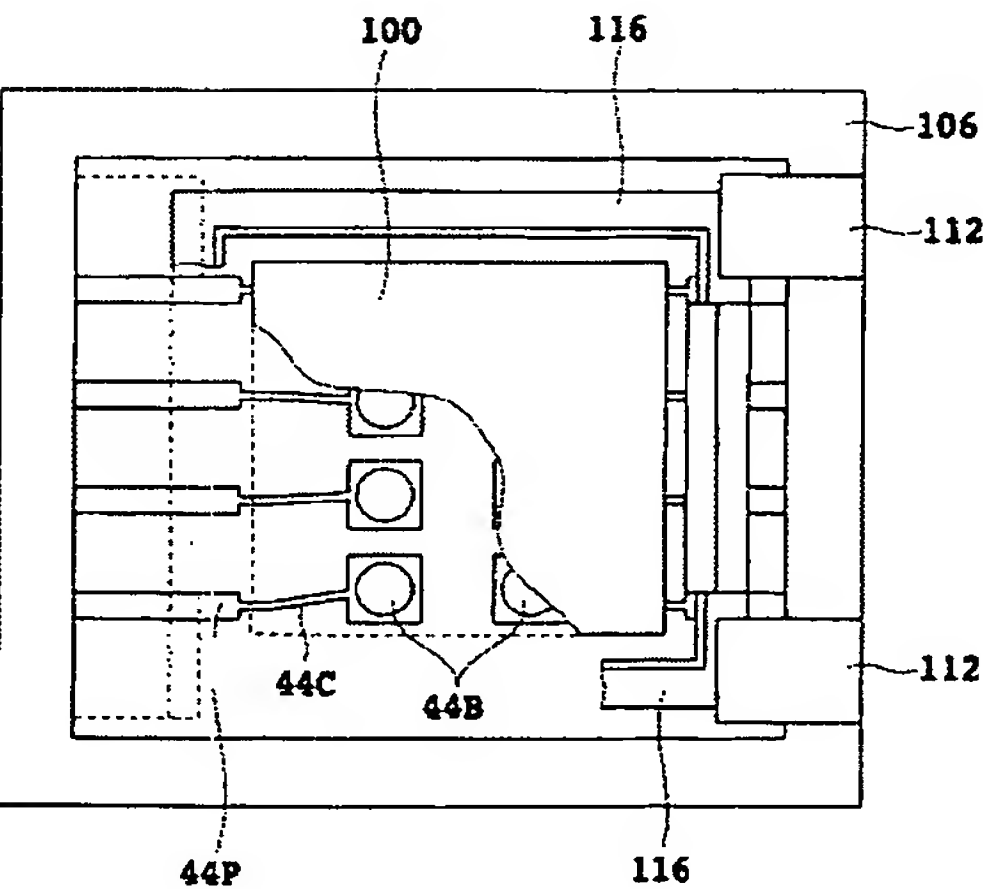
[Drawing 14]



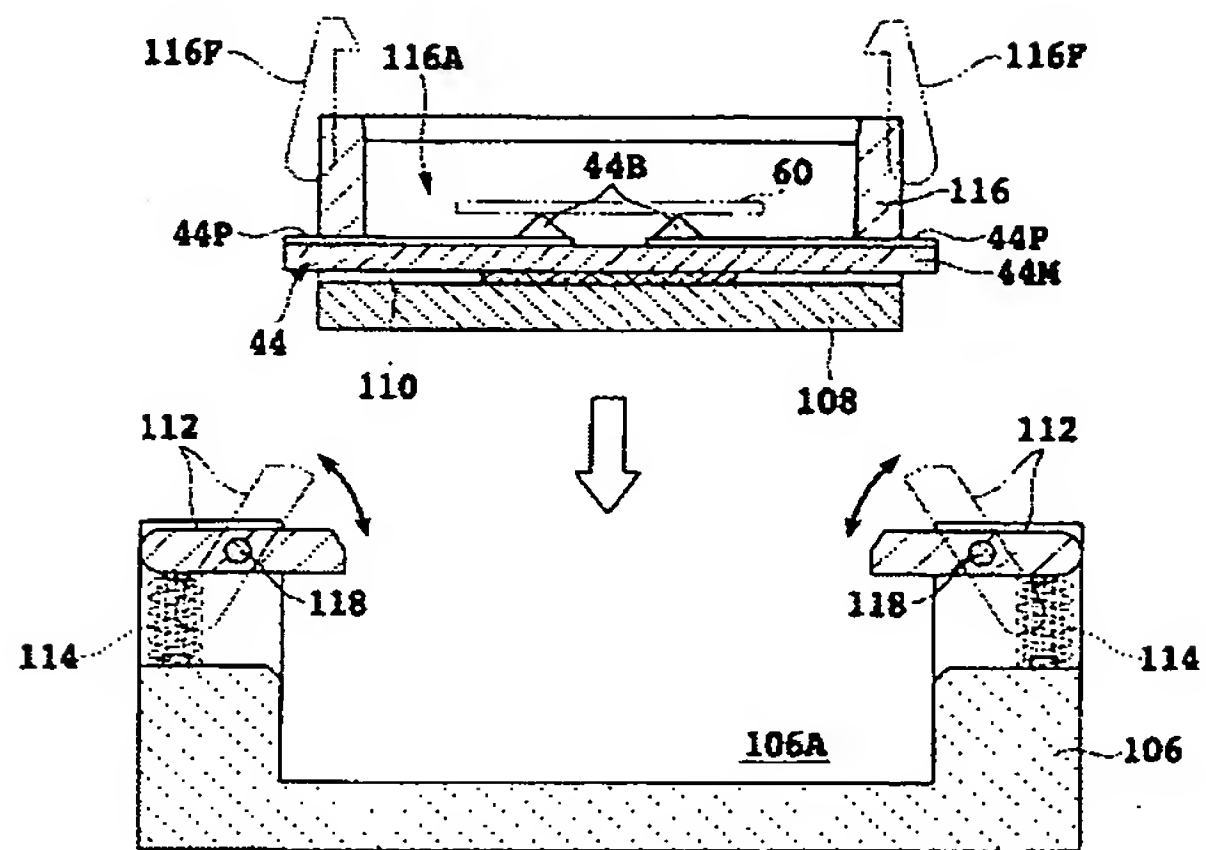
[Drawing 15]



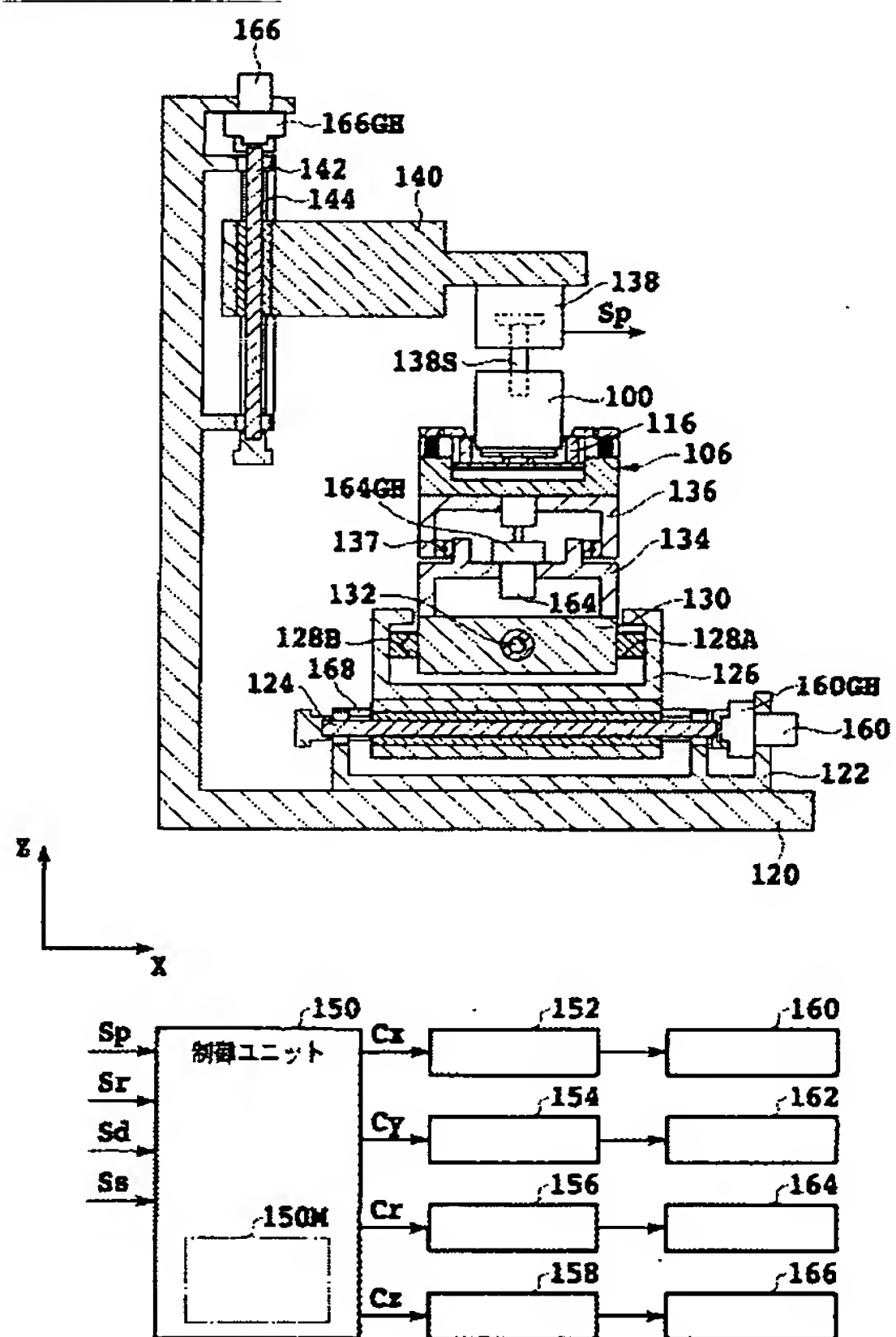
[Drawing 16]



[Drawing 17]



[Drawing 18]



[Translation done.]